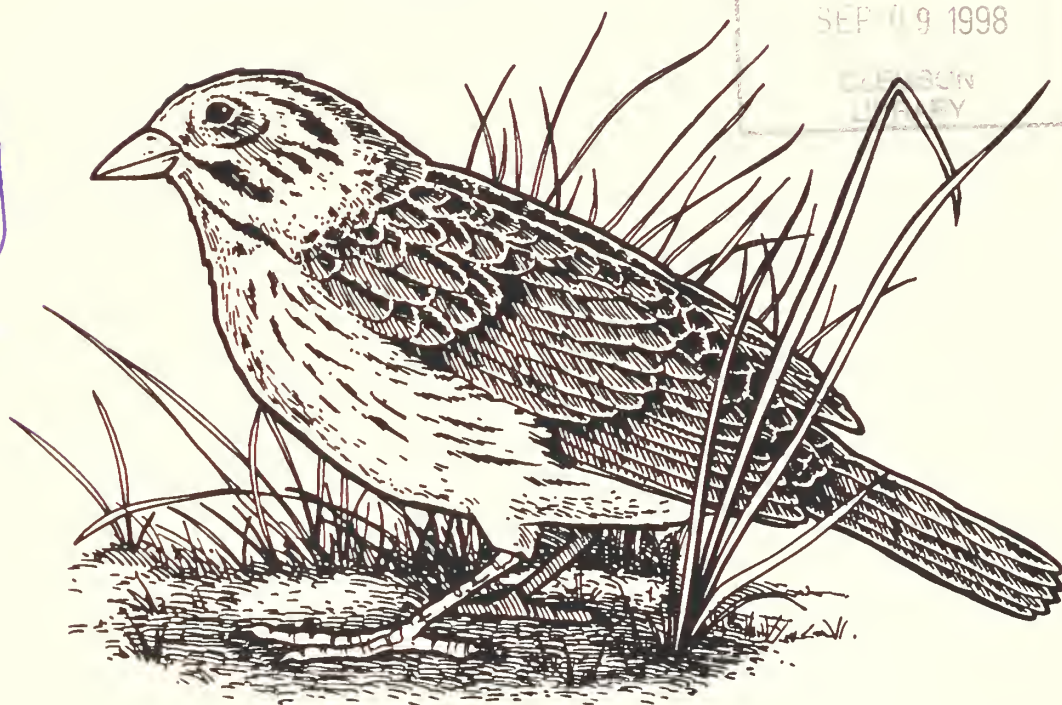


Baird's Sparrow Status Assessment and Conservation Plan



Prepared by:

Stephanie L. Jones
Nongame Migratory Bird Coordinator
U.S. Fish and Wildlife Service
Region 6

and

Michael T. Green
U.S. Department of Agriculture
Animal and Plant Health Inspection Service

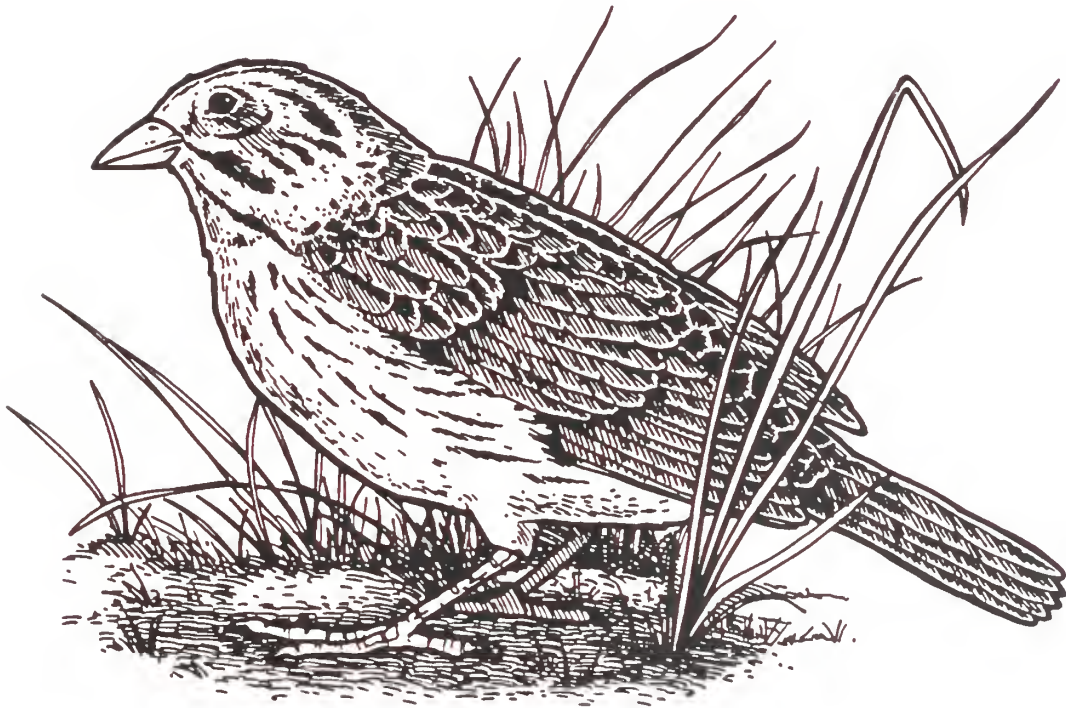
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Authors:

Stephanie L. Jones
Nongame Migratory Bird Coordinator, USFWS Region 6
P.O. Box 25486 DFC
Denver, CO 80225
303-236-8145 ext. 608
FAX: 303-236-8680
Stephanie_Jones@fws.gov

Michael T. Green
USDA, APHIS
4700 River Road
Riverdale, MD 20737-1236
301-734-7121
FAX: 301-734-5992
Michael.T.Green@usda.gov

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EXECUTIVE SUMMARY

Baird's Sparrow (*Ammodramus bairdii*) is a grassland specialist endemic to the northern Great Plains. Its behavior and ecology have been shaped by the historical conditions of the Great Plains and the health of its populations are dependent on the conditions of native prairie. Populations of many grassland birds, including Baird's Sparrow, have experienced dramatic declines due to the diminution and deterioration of native grasslands. Further population declines are likely to continue unless efforts are made to end the destruction of native prairie and to properly manage grasslands. Without a new emphasis on prairie management, Baird's Sparrow and other prairie specialists could ultimately be considered for listing under the Endangered Species Act.

Baird's Sparrows have had apparent declines in their populations since their discovery and further significant declines were documented by the Breeding Bird Survey between 1966-1979. The breeding distribution has remained primarily the same since 1844, except it is now largely missing from its eastern margins in Minnesota and Manitoba. These declines resulted in Baird's Sparrow being proposed for listing under the Endangered Species Act in the United States and under the Committee on the Status of Endangered Wildlife in Canada. In 1991, the United States determined that there was not enough data to make a recommendation. In 1997, Baird's Sparrow was re-proposed for listing as threatened in the United States. In 1989, Canada designated Baird's Sparrow as a threatened species and completed a recovery plan in 1993. In 1996, the species was delisted in Canada, primarily due to population estimates in Saskatchewan. The declines documented by the BBS have leveled off since 1980, and trends have remained stable or increasing between 1980-1997.

Habitat loss, mainly through the conversion of native prairie and grasslands to agriculture continues to be the primary threat to Baird's Sparrow populations. Modern agriculture practices, such as haying, mowing, and plowing can result in reproductive failures. High intensity and long duration grazing can also negatively affect Baird's Sparrow populations. The expansion of exotic vegetation in the grasslands and increasing predation and parasitism rates are also threats to Baird's Sparrow populations.

Baird's Sparrows show little site fidelity between years, shifting their populations within the northern Great Plains, primarily in response to fluctuating climatic, and therefore grassland, condition. This nomadism has to some degree hampered a clear assessment of population status of the species that has also been confounded by a lack of standardization or coordination in survey and habitat assessment methods in different geographic portions of their range. Little data are available from wintering grounds.

Although Baird's Sparrow experienced major historical declines with the conversion of native prairie to agriculture, population trend data is currently stable. Current population estimates for most states and provinces in the breeding range are unknown, variable, or controversial; however, many populations are higher than originally thought. There is no question that Baird's Sparrows are adversely affected by the conversion of native prairie to cropland. The greatest needs are for assessment of population and trends, reproduction from marginal habitats and the determination of the effects of various management activities in different portions of the Baird's Sparrow's range.

ACKNOWLEDGMENTS

We especially thank the authors of the State and Provincial summaries for researching and providing details on Baird's Sparrows in their areas. Special thanks to Bill Howe, who thoroughly reviewed the scattered literature and records of occurrence for Baird's Sparrows on the wintering grounds; Brenda Dale who contributed an invaluable and thorough review of the literature on habitat requirements and effects of various management practices on Baird's Sparrows; Stephen Davis who allowed us to use his new data on nesting and reproduction and who thoroughly and heroically reviewed this document more than once; Joanne Munro for the range map; and Caleb Gorden who contributed his knowledge of Baird's Sparrow wintering natural history. The overall content of these summaries and appendices remain as submitted in most cases. However, we have edited and altered the original submissions to various degrees, and take responsibility for any errors found in those summaries, as well as in the body of the report.

We thank all the biologists who attended the two meetings, researchers and reviewers for their contributions and reviews of earlier versions of this document, including O. Bray, J. Bradley, D. Buckland, D. Casey, J.E. Cornely, B.C. Dale, S.K. Davis, K.D. De Smet, J.S. Dieni, D.C. Duncan, D. Flath, G.R. Geupel, J.P. Goossen, C. Gordon, P. Gouse, T. Grant, T. Gutzke, L. Hanebury, W. Howe, S.N.G. Howell, L. Igl, D.H. Johnson, N. McPhillips, R. Murphy, L. Nordstrom, L. Osbourne, D.F. Prellwitz, D. Prescott, J. Price, J. Reichel, D. Searls, J.R. Sauer, D. Sullivan, M. Williams, and M. Winter.

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This report is dedicated to two Montana ornithologists: Jim Reichel (Montana Natural Heritage Program) and Phil Wright (University of Montana). With their passing, we have lost a wealth of knowledge about Montana birds and two good friends; they are missed.

Finally, we would like to acknowledge the sparrow itself, which captures the imaginations of many, delights with its song, amazes with its secrecy, and instills a sense of concern for an ecosystem that it needs and that needs it. It is our intent that this document summarizes the current status of Baird's Sparrows. Furthermore, it is our hope that the information herein will stimulate further research into effective management techniques and its natural history throughout its range.

BAIRD'S SPARROW (*Ammodramus bairdii*) STATUS ASSESSMENT AND CONSERVATION PLAN

TAXONOMY

Common Name: Baird's Sparrow

Scientific name: *Ammodramus bairdii* Audubon

Order: Passeriformes

Family: Emberizidae

There are no unsettled taxonomic issues. Originally known as *Emberiza bairdii* Audubon 1844, its closest relative appears to be Henslow's Sparrow (*Ammodramus henslowii*) (Zink and Avise 1990). There are no subspecies designated (AOU 1957). The type specimen was collected near Old Fort Union, North Dakota in 1843.

LEGAL STATUS

United States: Baird's Sparrow was proposed for listing under the Endangered Species Act (ESA), and the U. S. Fish and Wildlife Service (USFWS) determined that there was not enough data available to make a recommendation at that time (USFWS 1991). It was again proposed for listing in 1997 (Biodiversity Legal Foundation 1997). This document is a review of the available data and data needs. Baird's Sparrow is also considered a "Species of Special Concern/Watch List Species" by "Partner's in Flight" and National Audubon Society (Carter et al. 1996) and a "Species of Management Concern" by the USFWS Migratory Bird Management Office in 1987 and 1995 (USFWS 1995). The Nature Conservancy has assigned it a global rank of rare to widespread and of long-term concern (G4/G3), because of its limited range (M. Morrison, 1995, written commun.).

Canada: In 1989, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed it as Threatened. A recovery plan for Canada was published in 1993 (Goossen et al. 1993). In May 1996, COSEWIC removed it from the list, primarily due to large population estimates from Saskatchewan (Skeel, et al. 1995, COSEWIC 1996).

Mexico: No legal status.

Table 1 is a summary of the legal status of Baird's Sparrow in the all the states and provinces where it occurs and Appendix A has details of its status in these state and provinces.

DESCRIPTION

Baird's Sparrow is a small, brown, streaked oscine, similar to the closely related Savannah Sparrow (*Passerculus sandwichensis*) and Grasshopper Sparrow (*Ammodramus savannarum*). Average body mass of breeding males from North Dakota is 19.1 g (SD = ± 1.0 ; range = 17.0-21.3 g; n = 65; MTG). Tables 2 and 3 show the linear and mass measurements from study skins and live birds.

Baird's Sparrow has a tan, buff, or tinged yellowish (ochre) face, with a prominent dark spot on the upper rear of the ear coverts, near the end of an otherwise tan superciliary. Additionally it has dark-tipped ear coverts and a dark moustache; these form three dark spots making an incomplete

semi-circle around the ear coverts. The upper collar is unstreaked and whitish-tan, which accentuates the dark spots, while the lower collar is streaked, merging with streaking on the upper breast. The median stripe is orangish-ochre blending into a light-tan and finely streaked nape, and bordered by dark brown crown stripes which divide toward the nape. The throat is whitish bordered by blackish-brown whiskers that are narrow and short on some birds, but more prominent and wider toward base on others (Godfrey 1986). The upper breast is lightly streaked with narrow, short streaks, which coalesce into a diffuse central spot on some birds. The mid- and lower-breast is unstreaked, from light tan to whitish; the streaked flanks are often covered by the wings while at rest. The back is streaked overall with dark-brown and whitish-cream, which results from the scapulars, rump, tertials, and back feathers having dark brown centers, bordered by chestnut and a wider light tan or whitish margin. The shoulder (lesser upper secondary coverts) is tan-brown and the greater upper, and median upper secondary coverts are tan with expanding dark brown center toward tip, forming two incomplete dark wing bars. The tan edge to otherwise brownish gray primaries give the wings a tan look overall when at rest. The tail feathers are brownish gray with narrow cream-white edge, that is noticeable in flight and on perching birds. The tail is only mildly notched (Godfrey 1986, Howell and Webb 1995, MTG).

The females and males are similar; however, on average the females tend to be slightly more streaked than males on upper breast, and less noticeably colored on the crown and face than males (W. Godfrey, pers. commun., MTG).

The songs of Baird's Sparrows are composed of a series of quick, clear introductory notes followed by a trilled ending; some songs lack a trill. Each male sings only one song of about 15 different song types recorded for the species (Green 1992). These song types are not regionally distinct, but are distributed throughout the range. There are several types of call notes, perhaps the most commonly heard being a rather thick chip; other calls include a high, thin 'seep' note, a series of upslurred tonal notes, twittering that sometimes ends with a rapid series of 'deer' notes, and harsh calls uttered when under stress.

RANGE

Breeding

Baird's Sparrows were historically common throughout the Dakotas (Coues 1878) and are currently common in native prairie in the Missouri Coteau region of North Dakota (Stewart 1975; Figure 1). Their present range extends from southeastern Alberta to northwestern Iowa, from east of the Missouri and Yellowstone rivers and extending through northwestern and central North Dakota, into south-central South Dakota (AOU 1983) where they are rare to uncommon (Peterson 1995). In the shorter, drier grasslands west of the Missouri and Yellowstone rivers Baird's Sparrows are uncommon and rare (Stewart 1975). They are uncommon in the grasslands of the eastern and north-central portion of Montana, but common in the northeastern corner (Ellis et al. 1996). Formerly a common breeder in northwestern Minnesota in the 1920's, Baird's Sparrows are now greatly reduced in number and limited to one area of native prairie in Grand Forks County (Janssen 1987, Coffin and Pfannmuller 1988). Baird's Sparrows commonly breed in southeastern Alberta, through southern Saskatchewan, and into

Table 1. Summary of legal and natural history status of Baird's Sparrow throughout its range.

Natural Heritage Rankings: G=Global; S=State; B=breeding; N=nonbreeding; Z=zero occurrences; U=unrankable; A=accidental; ?=not ranked; 1=critically imperiled; 2=imperiled; 3=rare and uncommon; 4=widespread.

State/Province	Status	Legal Status	Natural Heritage Rank
UNITED STATES			
Arizona	Regular breeder/winter resident	No designation	G3/G4
	Winter Resident	Threatened	S2N
Colorado, Kansas, Nebraska, Oklahoma, Wyoming	Regular Migrant	No designations	SZN,SN,S?
Minnesota	Regular breeder	Endangered	S1
Montana	Regular breeder	Species of Special Concern	S3S4B, SZN
New Mexico	Winter Resident	Threatened	S2N
North Dakota	Regular breeder	No designation	SU
South Dakota	Regular breeder	No designation	S2B, SZN
Texas	Winter Resident	No designation	S2
CANADA			
Alberta	Regular breeder	No designation	S4B?
Manitoba	Regular breeder	Red List species	S2S3B?
Saskatchewan	Regular breeder	Endangered	S3B, SZN
MEXICO			
Chihuahua	Winter Resident	No designation	N/A
Coahuila	Winter Resident	No designation	N/A
Durango	Winter Resident	No designation	N/A
Sonora	Winter Resident	No designation	N/A

Table 2. Linear measurements (mm) of Baird's Sparrow. Data shown as mean \pm SD (range; n). Museum study skins from the Museum of Vertebrate Zoology, U.C. Berkeley, n = 11.

Measurement	Adult Males	Adult Females
Total Length	121.1 \pm 7.4 (115.9-126.3; 2)	128.4 \pm 3.8 (122.1-134.1; 7)
Wing Chord	65.5 \pm 6.2 (62.5-68.5; 2)	69.5 \pm 2.7 (66.0-75.0; 7)
Rectrices	50.0 \pm 4.8 (48.0-52.0; 2)	53.4 \pm 1.9 (50.0-56.0; 7)
Tarsus	20.56 \pm 1.77 (19.73-21.38; 2)	19.79 \pm 1.99 (17.49-23.85; 7)
Middle Toe	13.56 \pm 2.18 (12.01-15.1; 2)	14.56 \pm 1.27 (13.73-16.22; 5)
Exposed Culmen	9.12 \pm 1.32 (8.89-9.34; 2)	9.04 \pm 0.64 (8.15-9.94; 7)
Culmen Depth	5.88 \pm 0.24 (5.71-6.05; 2)	6.35 \pm 0.48 (5.91-7.52; 7)

Table 3. Measurements and mass of males from North Dakota (Green 1992).

Characteristics	Measurements	SD	Min.	Max.	Number (n)
Weight (g)	19.1	1.0	17.0	21.3	65
Wing Chord (mm)	70.0	2.0	66.0	74.0	93
Tail length (mm)	50.0	2.0	43.0	56.0	91
Culmen (mm)	8.2	0.5	7.5	11.8	93
Tarsus (mm)	21.6	0.6	19.2	24.0	92

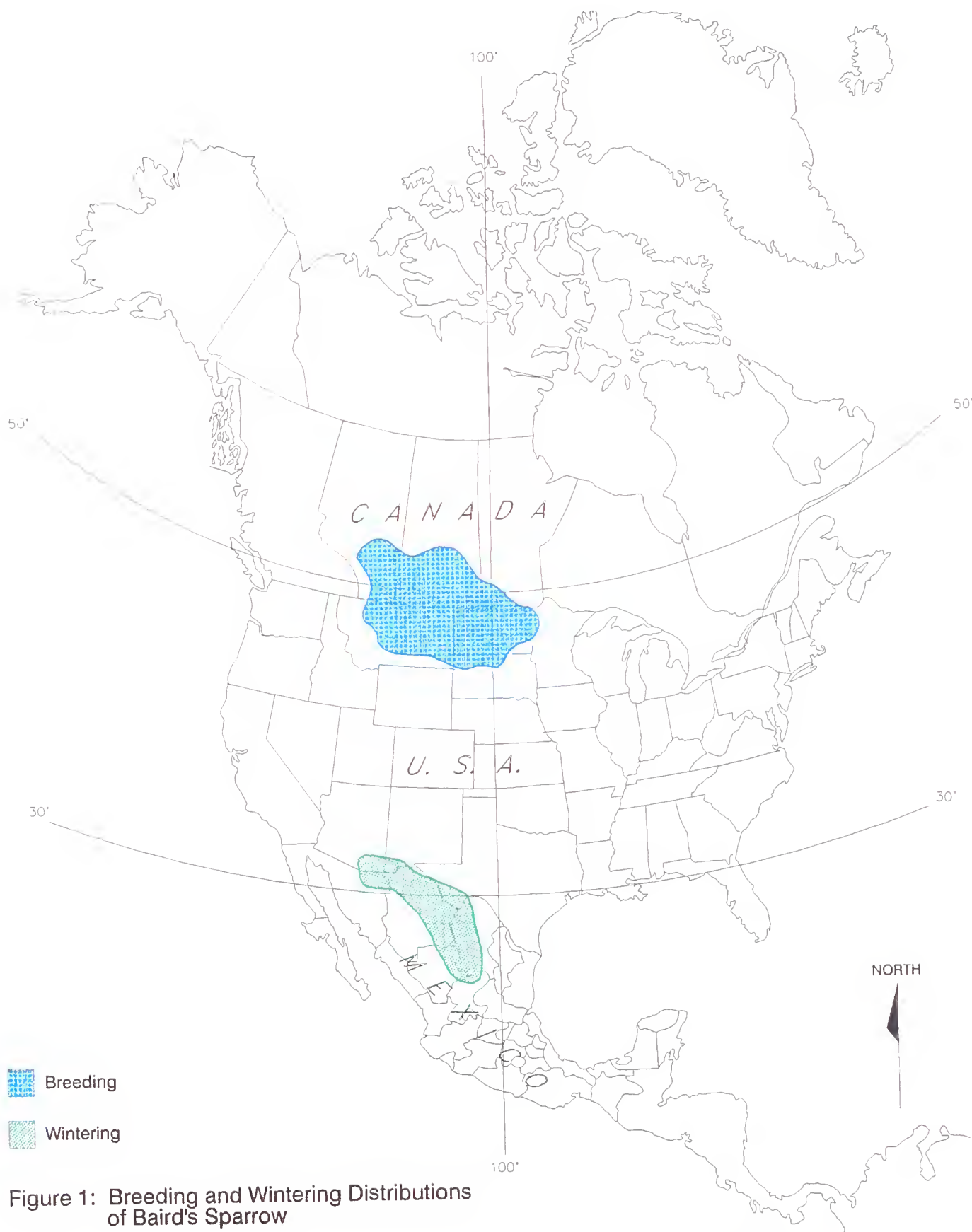


Figure 1: Breeding and Wintering Distributions of Baird's Sparrow

southwestern Manitoba, loosely bounded by the Aspen Parkland physiographic region to the north and east, and by the Rocky Mountain forests to the west (Godfrey 1986), although Baird's Sparrows can be found in low numbers in the Aspen Parkland Region of Saskatchewan (Davis et al. 1996).

Migration

Baird's Sparrows are found in all prairie states (AOU 1957, 1983), including Kansas (Thompson and Ely 1992), Oklahoma (Sutton 1967), eastern Wyoming (Oakleaf et al. 1992) and eastern Colorado (Andrews and Righter 1992). There are a few, mostly unverified, records of occurrence for Nebraska (Ducey 1988), Iowa (Dinsmore et al. 1984), northern Wisconsin (Robbins 1991), and Missouri (Robbins & Easteria 1992) and they are usually considered hypothetical, vagrant, or casual in these states. Extralimital records exist for several states, including New York, California, and Maryland (DeSante and Pyle 1986), Illinois (Bohlen 1989), British Columbia (Kautesk 1982), Ontario (Lemey 1981), and West Virginia (Breiding 1985; Appendix A).

Winter

Baird's Sparrow wintering range includes the grasslands of southeastern Arizona, southern New Mexico, and southern Texas in the United States and northern Mexico in portions of the states of Chihuahua, Coahuila, Durango, and Sonora (AOU 1983, Howell and Webb 1995; Figure 1).

NATURAL HISTORY

Migration

Baird's Sparrows are thought to migrate as individuals or in small groups. During migration they are quiet, secretive and difficult to see. It is thought that most individuals migrate at night at high altitudes (Thompson and Ely 1992).

They arrive on breeding grounds from early- to mid-May, sometimes as late as early June in the northern extremes of the range (Cartwright et al. 1937). Southward migration begins in August, possibly late-July for some individuals, while some birds may remain on breeding grounds until October (Lane 1968). Records from Arizona and New Mexico indicate that individuals arrive on wintering grounds in early-to mid-August, and some individuals remain as late as mid-May.

Breeding

Baird's Sparrows earliest documented arrival date is 4 May (Davis and Sealy in press A, L.D. Igl, D.H. Johnson, and H.A. Kantrud, unpubl. data) to as late as the second week of June (Cartwright et al. 1937). Baird's Sparrows arrive in Alberta by 10 May (Semenchuk 1991).

They breed in the northern Great Plains from late May to mid-August, with peak activity from early June to late July. Egg laying dates average from June 5 to July 21, but eggs are occasionally laid in late May. Dependent fledglings have been observed as early as June 30 and as late as August 18 (Stewart 1975, Davis and Sealy in press A).

Nests are in a scrape on the ground and made of grasses with occasional strands of horse hair, moss, stems of forbs, or other fine materials (Lane 1968). Nests are hidden in the grass and are usually constructed in depressions or scrapes in the ground, and are overhung by tufts of grass. Nests are always concealed from above and can be difficult to find (Lane 1968, Cartwright et al. 1937, G. Geupel/MTG/SLJ.). Nests in Manitoba averaged 6.2 ± 0.1 cm in diameter and 4.6 ± 0.1 cm deep (n=64), with 61% of the nests located in scrapes at the base of a clump of a narrow leaf grass species (Davis and Sealy in press A).

Clutch size varies from 3 to 6 eggs, with a mean of 4.7 eggs; 5 is the most common clutch size (Cartwright 1937, Stewart 1975) although 4-egg clutches are frequently observed (Davis and Sealy in press A). The length of incubation is 11-12 days, and young fledge between 8-11 days (Davis and Sealy in press A). Mean egg size is 19.3 ± 0.1 mm long by 14.7 ± 0.0 mm (range 17.0-21.3 mm long and 13.3-15.6 mm wide, n=251; Davis and Sealy in press A).

In Manitoba, a banded female initiated a second clutch 5-8 days after fledging the first brood (Davis and Sealy in press A). Breeding dates and behaviors of adults indicate that two broods are produced by some pairs in some years (Mahon 1995, MTG/SLJ); however, Lane (1968) believed that second broods were not normally produced.

Fifty percent (n=71) of nests fledged at least one young with a mean of 1.4 ± 0.2 young fledged per nest while successful nests fledged an average of 2.8 ± 0.2 young per nests (Davis and Sealy in press A). Nest success for Manitoba was 37% with the daily survival rate similar for the nestling and incubation stages (Davis and Sealy in press A); in Montana nest success in 1996 was 57% (n=21; SLJ) for all stages. Nests were an average of 67.9 m (range 6 - 365 m) from the nearest perch at least 1 m high (Davis and Sealy in press A).

Breeding densities from several studies were summarized by Sousa and McDonal (1983). Densities varied from 11.5 pairs/40 ha to 22.5 pairs/ 40 ha for ungrazed, undisturbed prairie in Alberta (Owens and Myres 1973), Saskatchewan (Maher 1979) and North Dakota (Stewart and Kantrud 1972). Densities on grazed sites were reported to be less than 5 pairs/40 ha (Maher 1979; Renken and Dinsmore 1987). Densities on burned sites had significantly more individuals on plots burned 4 times (3.2 males per 16 ha/8 males per 40 ha) than on plots burned 2 times (1.1 males per 16 ha/2.75 males per 40 ha) between 1970 and 1992 (Winter 1994, Madden 1996). Schmidt (1990) found 10-32 singing males/40 ha at the McIntyre Ranch near McGrath, Alberta. In a 5-year survey at Lostwood National Wildlife Refuge (LNWR) in northwestern North Dakota, 8.5, 30.6, 32.5, 22.6, and 21.2 males/40 ha were found between 1987-1991 (MTG).

Territory

Average breeding territory size ranges from 0.68 ha to 1.2 ha, with larger territories reported during the first few weeks of territory establishment (Winter 1994). Territories in sites with the highest densities averaged 1.05 ha (0.89-1.43 ha, n=11), while territories averaged 1.42 ha (1.19-1.75 ha) in less densely inhabited sites (Winter 1994). Lane (1968) reported territory size to range from 0.4-0.8 ha.

There is anecdotal evidence that males prefer to establish territories next to each other, suggesting that the species might be semi-colonial (Winter 1994, MTG/SLJ).

Site fidelity

Baird's Sparrow and several other grassland species are noted for a lack of breeding site fidelity, appearing semi-nomadic in response to climatic fluctuations (Green 1992, Price 1995). In a 4-year study at LNWR, only 5% of color-banded breeding males returned to breed at the same site they occupied the previous year (n=95). Those that returned once (n=5) appeared to be more likely to return for a third year (n=3), and one returned for a fourth year (Green 1992). These data, in addition to frequently significant yearly fluctuations in populations (De Smet and Miller 1989, Lane 1968; Figure 2), and apparent lack of geographical variation in song (Green 1992) indicate a semi-nomadic migratory behavior.

POPULATION ESTIMATES AND TRENDS

Population estimates

The overall breeding distribution of Baird's Sparrows has probably remained basically unchanged since its discovery in 1843 (Coues 1878), except it is now mostly missing from the eastern margins of its historical range in Minnesota and Manitoba (Coffin and Pfanmuller 1988, De Smet and Miller 1989; Figure 3). Population numbers may have been reduced drastically from the 1800's when Coues (1878) called Baird's Sparrows "one of the most abundant species in the Dakota Territory." These population declines are undoubtedly due to conversion of native prairie to agriculture and to modern agricultural practices.

The North Dakota population of Baird's Sparrow was estimated in 1967 (Stewart and Kantrud 1972) and this methodology was repeated in 1992 and 1993 (Igl and Johnson 1997). The average density of Baird's Sparrows was 0.8 pairs/40 ha in 1967 (Stewart and Kantrud 1972) and the estimate of the North Dakota population was 376,000 pairs (95% confidence interval = 208,000-543,000 pairs). In 1992 the same study design yielded a statewide estimate (with 95% confidence interval) of 171,000 pairs (90,000-251,000), and in 1993 the estimate was 279,000 (140,000-418,000) (Igl and Johnson 1997). The distribution of Baird's Sparrows in any given year, like that of other prairie birds, maybe tied to precipitation patterns (Knopf 1994). Thus, the fact that in 1967 typical precipitation was recorded, while 1992 was a dry year and 1993 a wet year may explain some of the variations in densities in North Dakota.

Population estimates in Canada have been derived from various techniques and are probably not directly comparable to each other. The total population of Baird's Sparrows in Alberta was estimated to be 9,300 males (18,600 individuals) (Goossen et al. 1993). The total population in Manitoba was estimated to be 1,700 males (3,400 individuals) (K. De Smet written commun.). The total population of Baird's Sparrow in Saskatchewan for 1994 was estimated to be 0.95 million males (1.9 million individuals; 1.06-3.02 million individuals = 95% confidence limits) from surveys in grassland, hayland, and cropland (Skeel et al. 1995). This population estimate from Saskatchewan was thought to be too high by some reviewers. Criticisms of this study include a nonrandom habitat sampling bias, assumptions made about the distance singing birds

were from census takers, and lack of independence in the samples (B. Dale, written commun.). However, it is the most extensive survey to date of Baird's Sparrows in Saskatchewan, and might be the best measure of total population for that Province, until another census is undertaken. Baird's Sparrow populations remain high in portions its range (Schmidt 1990, D. Johnson pers. commun.) and some populations may be larger than previously believed (Skeel et al. 1995). However, local declines continue to occur (Janssen 1987, De Smet and Miller 1989) and some threats to Baird's Sparrow populations exist in many geographic areas.

Trends

During the period of 1966-1979, Baird's Sparrow showed persistent and steep declines for all areas, except Montana (Table 4). There was a significant downward trend (in mean annual percent change) in the continental population documented by the BBS for this period (Sauer et al. 1996). These declines are significant in 46% of the areas analyzed and the declines for the entire survey were significant ($p=0.05$) at -4.75 annually, with a small number of routes ($n=52$). These declines occurred in the geographic areas with one of the largest Baird's Sparrow populations in the northern Great Plains (Figure 4). De Smet and Miller (1989) suggest that the declines in the population in prairie Canada during the period 1970-1985, using BBS data, may be as great as 35-55%. For the period 1980-1996, the trends are level in most geographic areas, including the entire survey at 1.1 (non-significant; $n=95$), and significant increases were noted in the Glaciated Missouri Plateau region ($+3.3$; $p<0.20$; $n=41$; Table 4). BBS data in some areas are probably too sparse and variable to accurately determine population trends in many of the physiographic regions. The average trends over the 30 years (1966-1996) of the BBS shows Baird's Sparrow population trends to be stable. This trend equals -1.6 , non-significant for $n=115$ routes (Sauer et al. 1996; Table 4).

MONITORING ACTIVITIES

Breeding Bird Survey

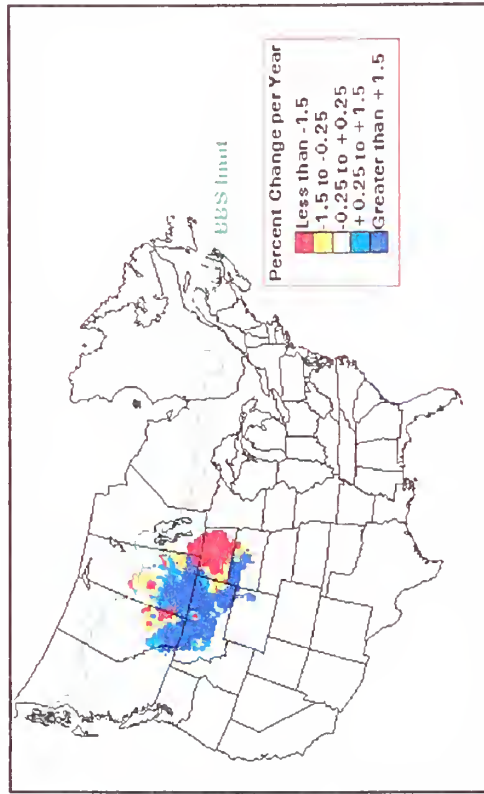
Monitoring efforts in the United States and Canada are mainly limited to the BBS. The interpretation of BBS data is limited by the number and distribution of routes completed in an area and by the negative roadside bias shown by Baird's Sparrow (Davis et al. 1996). There are several other ongoing monitoring studies currently being conducted by Canadian Wildlife Service, Saskatchewan Wetland Conservation Corporation and USFWS (Appendix A).

Christmas Bird Count

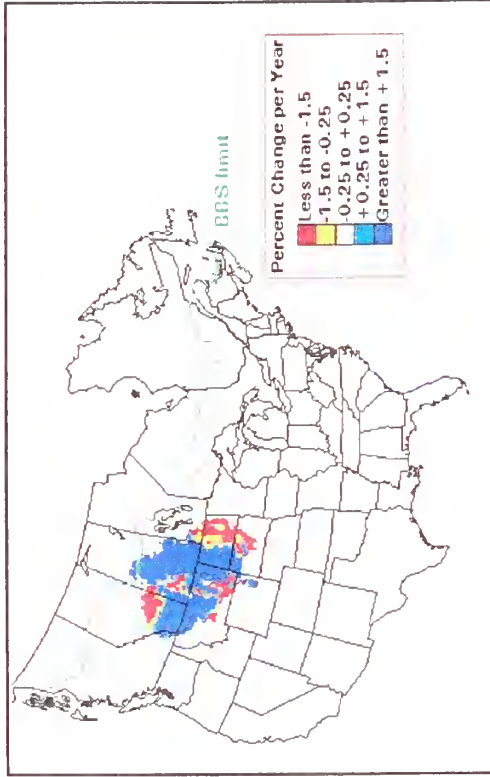
The Christmas Bird Counts (CBC) in the southern portion of the United States does not cover the Baird's Sparrow range, although they have been recorded during these surveys. Two CBC's that recorded Baird's Sparrows have recently been started in Mexico; but currently there are few monitoring efforts in the southern range (Appendix A).

BAIRD'S SPARROW TREND

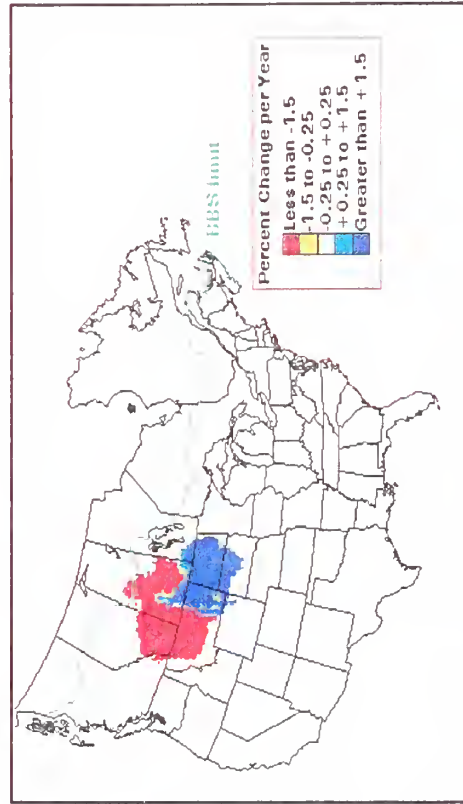
1966-1996



1966-1976



1977-1986



1987-1996

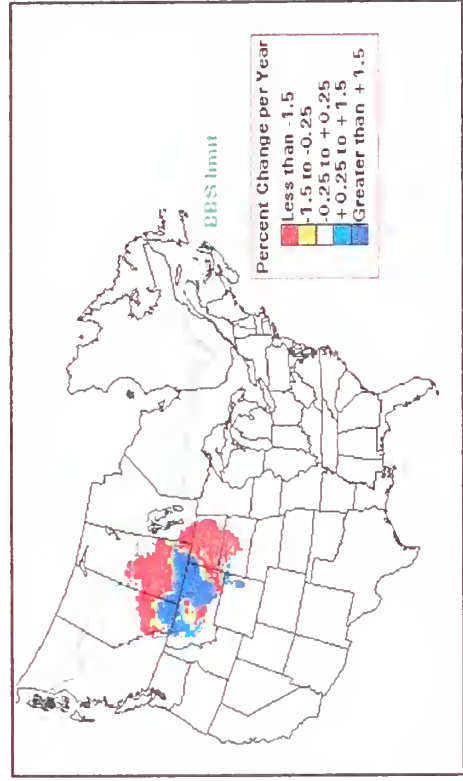


Figure 2. Examples of Baird's Sparrow's yearly population fluctuations using data from Breeding Bird Survey. Core populations remain fairly stable but other portions of the range show a wide change of densities (J.R. Sauer, J. Price, written commun.).

BBS SUMMER DISTRIBUTION MAP 1966-1996

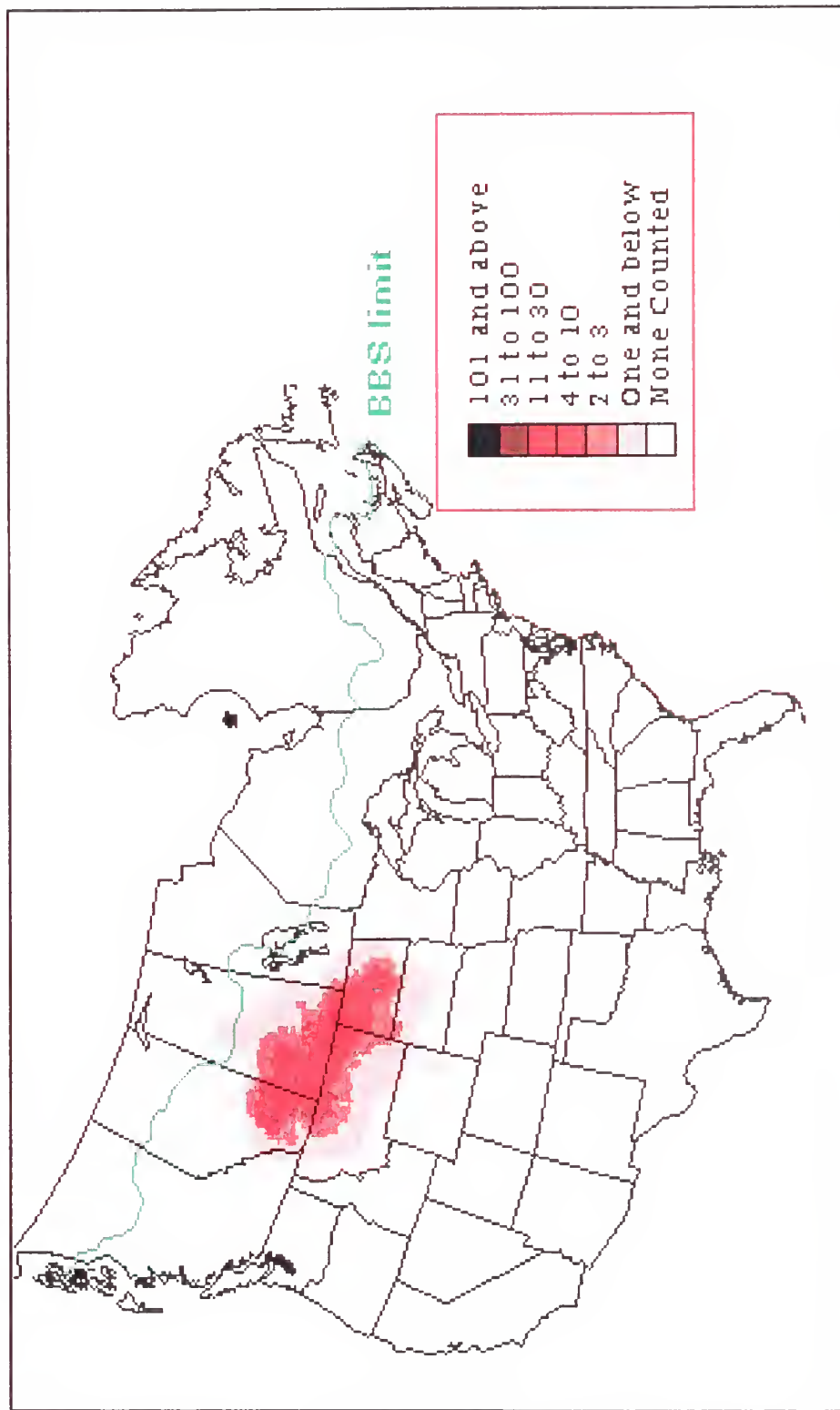


Figure 3. Summer distribution map for Baird's Sparrow from Breeding Bird Survey 1966-1996 (Sauer et al. 1996). This is the average relative abundance of the species detected per route per year.

BBS TREND MAP (1966-1996)

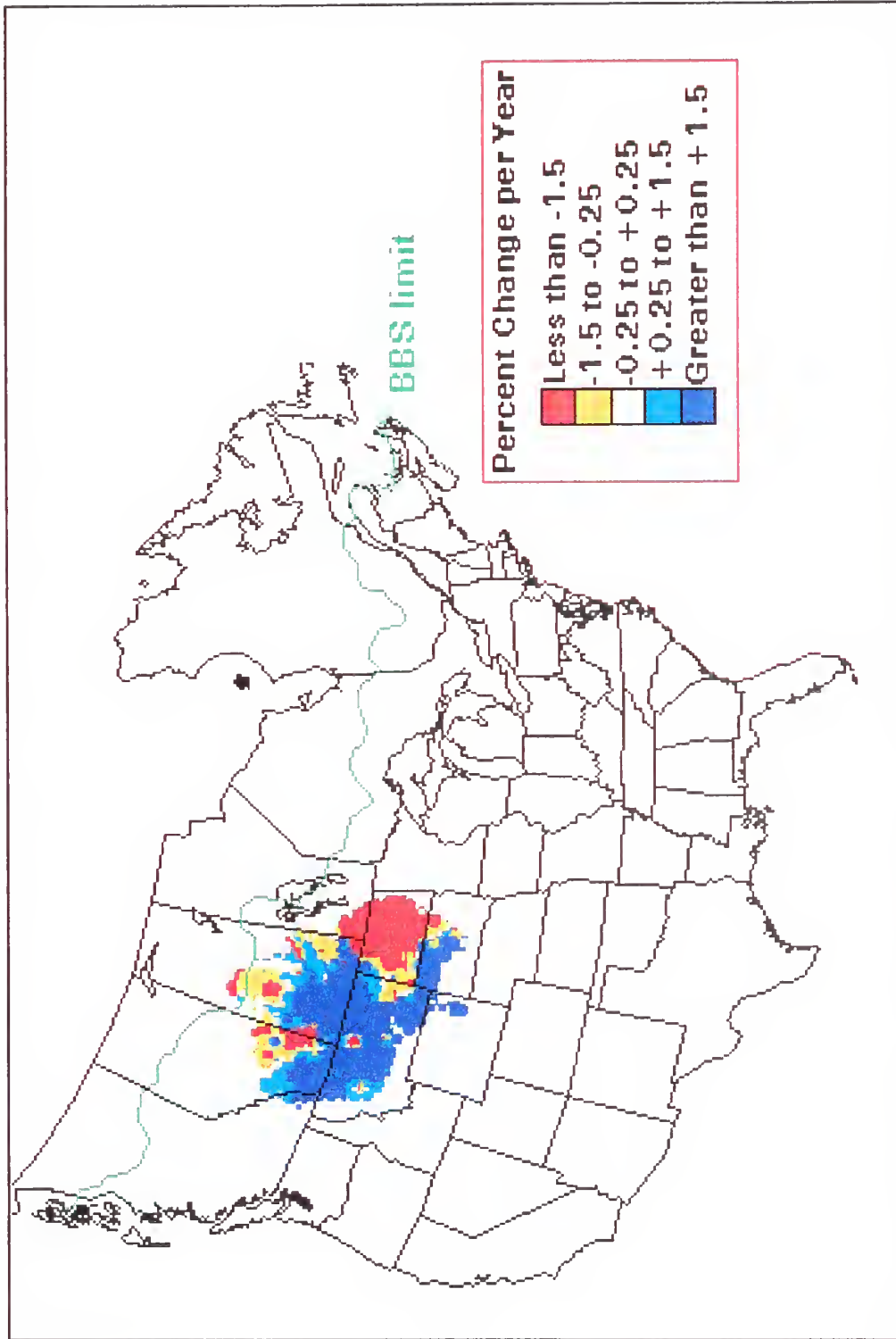


Figure 4. Annual population trend estimates for Baird's Sparrow from Breeding Bird Survey 1966-1996 (Sauer et al. 1996).

Table 4. Trends in average percent change per year for Baird's Sparrow from Breeding Bird Survey data from 1966-1996 (Sauer et al 1997). P: *= <0.20 ; **= <0.10 ; ***= <0.05 .

Area	1966-1996					1966-1979					1980-1996				
	Trend %	P	N	95% CI	Trend %	P	N	Trend %	P	N	Trend %	P	N		
Alberta	-0.4		23	-6.1 5.4	-8.2		11	-3.2		21					
Montana	1.0		19	-9.6 11.6	0.7		6	1.2		15					
North Dakota	-2.6	*	23	-6.1 0.9	-4.5	***	12	-1.9		23					
Saskatchewan	-1.1		36	-6.4 4.2	-6.0		18	2.3		25					
Drift Prairie	-2.0		30	-6.2 2.2	-7.5	***	14	1.0		28					
Glaciated Missouri Plateau	2.8	*	46	-0.9 6.6	-7.4		15	3.3	*	41					
Great Plains Roughlands	0.0		25	-8.8 8.9	-2.0		13	-3.7		19					
Central	-1.6		55	-6.2 3.0	-3.9	**	22	-1.4		48					
Western	-0.6		60	-4.2 3.0	-7.1		30	-0.2		47					
FWS Region 6	-1.6		48	-6.2 3.0	-4.2	**	21	-1.5		42					
United States	-1.6		49	-6.4 3.1	-4.1	**	21	-1.6		43					
Canada	-0.7		66	-4.3 2.9	-6.1		31	0.6		52					
Survey	-1.6		115	-4.4 1.3	-4.7	***	52	1.1		95					

HABITAT

Breeding season habitat requirements

Habitat preferences of Baird's Sparrows on the breeding grounds are traditionally described as being idle to light-moderately grazed tracts of native prairie (Cartwright et al. 1937). In northwestern North Dakota, Baird's Sparrows were most densely populated and had the smallest territories in grassland with litter up to 2 cm deep, <10% woody cover, relatively high coverage of forbs (20%), intermediate vegetation with an average height of 23 cm, and with a patchy distribution of forbs, grass and bare soil (Winter 1994; Appendix B). Litter was significantly deeper inside Baird's Sparrow territories than outside (1.19 cm vs. 0.87 cm) and sites with shrub cover greater than 25% are avoided. Baird's Sparrows prefer native grasslands that have a shrub cover <20%, litter depth >0 and up to 3 or 4 cm deep, and grass height from 10-20 cm or higher (Dale 1983, Sousa and McDonal 1983; Appendix B). The limited emergent shrubs that are present, both dead or alive, are often used as singing perches (Cartwright et al. 1937, Lane 1968) although not required since they sing from the ground, grass clumps, or forbs.

While breeding Baird's Sparrows may prefer native grasslands, they also occur in hayfields, seeded pastures (Sutter et al. 1995, Davis et. al 1996), weedy stubble fields and retired croplands (Kantrud and Kologiski 1983, Stewart 1975, De Smet and Conrad 1989, Davis 1994), wheat fields (Lane 1968), and in dry wetland basins (Goossen et al. 1993). Appendix B has a detailed discussion of the habitat requirements of Baird's Sparrow throughout their range.

Baird's Sparrows show a positive association with native grasses and a negative association with smooth brome (*Bromus inermis*) (Dale et al. 1993, Madden 1996). On Lostwood NWR, brome and other broad-leaved, exotic grasses were significantly less common in areas occupied by Baird's Sparrows compared to unoccupied areas (Madden 1996). Smooth brome is a codominant and increasing in mixed grass prairie on the northern and central Missouri Coteau and much of the northwestern Drift Plain in North Dakota. On xeric, sandy soils it is much less readily established and less able to compete with native, herbaceous flora.

Leafy spurge (*Euphorbia esula*) and western snowberry (*Symphoricarpos occidentalis*) are exotic species that are invading native prairie and other untilled uplands in North Dakota. In some portions of their range, idle native prairie can gradually become dominated by these species. Both of these species create monotypic stands and conditions that make the habitat unsuitable for Baird's Sparrows.

The results for crested wheatgrass (*Agropyron cristatum*) are mixed. Crested wheatgrass may be suitable for Baird's Sparrow since it is structurally similar to native grasses, particularly when grazed or burned (Madden 1996, Davis and Duncan in press). Baird's Sparrows have shown equal or higher densities in comparisons between grazed stands of native grasses and grazed stands of crested wheatgrass in Saskatchewan (Davis and Duncan in press, Skeel et al. 1995, Sutter et al. 1995) and Alberta (Mahon 1995). However, idle crested wheatgrass in North Dakota was not attractive to Baird's Sparrow (Johnson and Schwartz 1993), while burned crested wheatgrass was tolerated (Madden 1996).

Some invasion by Kentucky bluegrass (*Poa pratensis*) is also accepted (Madden 1996), suggesting that Baird's Sparrows will use exotic species that are structurally similar to native mixed grass prairie.

Baird's Sparrow can be significantly associated with the size of grassland fragment and are an area sensitive species requiring approximately 63 ha (Davis 1998). A decrease in pasture size may also cause increases in parasitism (S. Davis written commun.).

Winter habitat requirements

Little is known about winter range habitat requirements. Baird's Sparrows are consistently seen in areas with dense and expansive grasslands, either solitary or in small numbers with other grassland specialists, including Grasshopper Sparrow and Savannah Sparrow.

Winter habitat relationships and movement patterns of grassland sparrows are the primary objective of an study in southeastern Arizona. Preliminary results suggest that Baird's Sparrows might be sedentary, with fixed winter home ranges within and between years (C. Gordon, written commun.; Appendix A).

MANAGEMENT

Effects of management techniques can vary greatly throughout the range of Baird's Sparrows. Climate, particularly average rainfall, and topography can greatly change the response of grassland vegetation to management techniques. Therefore, it is not always possible to apply the results from a local study across the geographic range. For example, controlled burning intervals could be longer in the northern drier prairie. Grazing might play a bigger role in grassland management in these dry areas than in the wetter portion of the mixed grass prairie. Appendix B is a detailed summary of the habitat requirements of the species and effects of different grassland management techniques on their populations.

Controlled burning offers one management tool for maintaining productive Baird's Sparrow habitat in the Missouri Coteau (Winter 1994, Madden 1996). In northwestern North Dakota, the vegetation characteristics preferred by Baird's Sparrow were more common in study areas burned 4 times, rather than 2 times or not at all between 1970-1992. Generally, populations decline in the first year after the burn, but then increase, reaching peak densities 2 to 4 years after the burn, followed by a decline in density in subsequent years (Winter 1994, Madden 1996, D. Johnson, pers. commun.). In northwestern North Dakota, unburned plots gradually become dominated by western snowberry and by thick, dense grasses that create habitat features avoided by Baird's Sparrows.

Many studies have demonstrated that Baird's Sparrows can tolerate light to moderate levels of livestock grazing, depending on duration and intensity of the grazing and the physiographic area (Appendix B). However, long duration and heavy grazing can result in abandonment of the area.

THREATS

Habitat: Baird's Sparrows are grassland specialists endemic to the northern Great Plains. The conversion of native prairie to cropland is the primary threat to Baird's Sparrow populations in breeding areas (Lane 1968, Stewart 1975, Owens and Myres 1973, Goossen et al. 1993). Over-grazing and poor rangeland management also contribute to the loss of Baird's Sparrow habitat (Goossen et al. 1993). Mixed grass prairie has declined 60-99% in acreage in the prairie provinces and North Dakota (Samson and Knopf 1994), with over 90% of the grasslands in Canada converted to agriculture. It is probable that Baird's Sparrow populations will decline in proportion to the conversion of native prairie.

Baird's Sparrow are associated with size of grassland fragments and decreases in pasture size may also cause increases in parasitism. Small fragments of prairie could act as population "sinks" creating declines.

Regulation of Baird's Sparrow populations could also be influenced by factors occurring on the wintering and migration areas. However, we know little about the natural history, habitat, range, and limiting factors of Baird's Sparrow on these areas.

Overutilization: Susceptibility to human disturbance is a factor in Baird's Sparrow distribution. Disturbances caused by plowing, brushing, burning, movement of livestock, grazing, haying, and mowing can result in the abandonment of an area and reproductive failure.

Disease or Predation: Disease has not been documented as a threat.

Predation can be a cause of reproductive failure in Baird's Sparrows (Davis and Sealy in press B). Predation frequencies ranged from 26% - 46% for nests in southwestern Manitoba (Davis 1994) to 50% - 71% in southern Saskatchewan (Davis 1998). Davis and Sealy (in press B) reported predation by striped skunk (*Mephitis mephitis*) and thirteen-lined ground squirrel (*Citellus tridecemlineatus*). Richardson's ground-squirrels (*Spermophilus richardsoni*) depredated eggs, nestlings, and fledglings at a site in Alberta (Mahon 1995). A weasel was suspected when an adult dead male was found mauled but uneaten near a nest with decapitated young (MTG). Other potential predators include American Crow (*Corvus brachyrhynchos*), Northern Harrier (*Circus cyaneus*), and western plains garter snake (*Thamnophis radix haydeni*) (Davis and Sealy in press B); in general, major predators are probably small mammals, birds, and snakes.

Baird's Sparrow nests are parasitized by Brown-headed Cowbirds (*Molothrus ater*). Davis and Sealy (in press B) found that 36% of 74 nests in southwestern Manitoba were parasitized with an average of 2 cowbirds eggs (range 1-4). Significantly fewer young were fledged from successful parasitized nests than from successful non-parasitized nests, resulting in an average cost of 1.1 Baird's Sparrow fledglings per parasitized nest. Egg removal by cowbirds was likely the primary cause of lowered productivity in parasitized nests. In Saskatchewan, 32% of 61 Baird's Sparrow

nests were parasitized, and 79% of parasitized nests contained more than one cowbird egg (S. Davis written commun.).

Inadequacy of existing regulatory mechanisms: Current regulations appear to provide Baird's Sparrows with adequate protection throughout its breeding range. Baird's Sparrows are protected in under the Migratory Bird Treaty Act (1918) in the United States, the Migratory Bird Convention Act (1916) in Canada and the Convention for the Protection of Migratory Birds and Game Mammals (1936) in Mexico. The ESA in the U.S. and COSEWIC in Canada will provide protection for the species if Baird's Sparrow becomes threatened with extinction. Baird's Sparrow is a USFWS Migratory Nongame Species of Management Concern (USFWS 1995). Baird's Sparrow was a Category 2 candidate for review for possible addition to the Federal endangered or threatened species list (USFWS 1991) until use of the Category 2 list was discontinued (USFWS 1996). Table 1 is a summary of the legal status of the species in states and provinces throughout its range.

No protection for Baird's Sparrow habitat exists for the breeding range in the United States and Canada. Incentive programs such as the Grassland Conservation Program offer some breeding habitat protection in upland easements in perpetuity. Other incentive programs such the Conservation Reserve Program (CRP) do not contribute habitat for Baird's Sparrow (Johnson and Igl 1995) since most cover currently re-seeded under this program is exotic grass or exotic grass/legume mixtures, which are unsuitable for Baird's Sparrow.

Current regulatory mechanisms are inadequate to protect the species and its habitats on the winter range. Mexico has no regulations to protect the habitat of Baird's Sparrow and current regulations protecting the species are not adequately enforced.

Other natural or manmade factors:

Pesticides: Not documented as a threat.

Population size: Conflicting data on population size make this factor difficult to evaluate. Populations are likely to be greater than earlier believed and remain high in many portions of the range.

Burning: Controlled-burning programs that mimic natural fire intervals and help re-create native prairie conditions are preferred by Baird's Sparrow in parts of their range. However, Baird's Sparrow will not use the area in the first year or two after a burn and the interval between burns will vary by region and is critical to a successful program (Appendix B).

Mowing: Baird's Sparrows are absent or sparsely distributed where mowing is greatest but they are sometimes found in stubble fields and fallow land (Bent 1968, Stewart 1975, De Smet and Conrad 1989). Baird's Sparrow nest initiation dates indicate that the July 15 haying date recommended by the North American Wetland Management Plan is too early (Davis et. al 1996; SLJ/MTG).

Grazing: Several studies have noted that Baird's Sparrows are found in moderately grazed native prairie, but are absent or very sparsely distributed where grazing is heavy (Kantrud 1981, Owens and Myres 1973, Stewart 1975, Dale 1983, Samson and Knopf

1994, Mahon 1995). There is evidence that grazed grasslands may support fewer Baird's Sparrows than in ungrazed areas in portions of their range (Owens and Myres 1973, Maher 1979, Dale 1983). Grazing affects vegetation height, percent bare ground, litter depth, and can compact the vegetation and soil. Response of the vegetation used to Baird's Sparrow to grazing varies geographically and with grazing duration and intensity.

Introduced Vegetation: Baird's Sparrow have shown a negative correlation with smooth brome (Dale 1983, Madden 1996). Although the response of Baird's Sparrows to leafy spurge has not been studied, this weed can dominate large patches of grasslands and changes the habitat features apparently critical to Baird's Sparrows. Other noxious species of weeds or exotic grasses could pose serious threats in the future to the long term survival of Baird's Sparrows in native prairie.

ASSESSMENT AND RECOMMENDATIONS

Recommendation on current status

We recommend no change in Baird's Sparrows status at this time. While the species has experienced major declines with European settlement of the prairies and the conversion of native prairie to agriculture, population trend data over the last 15 years show their populations to have become relatively stable. Current population estimates for most states and provinces in the breeding range are unknown and variable, but even the most conservative estimates indicate a large population in parts of the range. There is no question that Baird's Sparrows are adversely affected by the conversion of native prairie to cropland, resulting in a range constriction from the eastern margins of their historical range. Although singing males have been found in cropland and hayfields, their productivity in these habitats and circumstances under which they are used is unknown. Baird's Sparrows are apparently compatible with light grazing and could successfully reproduce in some haylands, but additional comparative studies are recommended to determine Baird's Sparrows tolerance to types and levels of grassland management. Essentially no information is available from the wintering grounds or from migration that would help determine population trends or recommend a change in status. Since threats still exist, Baird's Sparrow should remain a species of special concern and its status monitored.

CONSERVATION

Baird's Sparrows are a member of a guild of species that are dependent on the health and availability of native grasslands (Knopf 1994). Other grassland species could benefit to some degree from conservation efforts aimed at Baird's Sparrow, although details of their natural history, range, and habitat requirements will vary. Other grassland species include Sprague's Pipit (*Anthus spragueii*), McCown's Longspur (*Calcarius mccownii*), Chestnut-collared Longspur (*C. ornatus*), Western Meadowlark (*Sturnella neglecta*), Savannah Sparrow, Grasshopper Sparrow, Vesper Sparrow (*Pooecetes gramineus*), and Burrowing Owl (*Athene cunicularia*).

The BBS has documented general population declines in Baird's Sparrow and other grassland species of the Great Plains over the past 30 years (Sauer et al. 1996). Long term conservation of

Baird's Sparrows and associated species are linked to conservation of the native prairie ecosystem. CRP has contributed relatively little habitat for Baird's Sparrow, although other grassland species have benefitted from this program (Johnson and Igl 1995). In the United States, the only viable approach for the conservation of Baird's Sparrows is to conserve, restore, and actively manage native grasslands or to alter the structure of CRP lands. Due to extensive habitat loss, Baird's Sparrows will probably never recover to historic levels. However, where suitable habitat remains, the proper use and timing of mowing, grazing, and burning, along with restoration efforts where feasible, will be most successful in maintaining viable populations. While it is clear that in certain physiographic areas no active management, or ill-timed use of these management tools, has been detrimental to Baird's Sparrows, they do respond positively to native prairie restoration and will reoccupy formerly unuseable habitats.

Although fewer Baird's Sparrows have been counted in some years and in some areas compared to others, it may be that populations have shifted, in response to local environmental conditions (Figures 2 and 4). This species appears to be semi-nomadic, and might be able to find suitable habitat wherever it exists within the breeding range; however, if these shifts in distribution and abundance are related to weather conditions (Price 1995) then suitable habitat would need to be provided throughout the breeding range to accommodate locally variable weather and habitat conditions. The spatial and temporal dynamics of Baird's Sparrow could make it difficult to set aside or preserve suitable habitat because they may not be found in an area every year; however, in some regions population sizes do not fluctuate, and annual site use is more predictable (Figure 2). Price (1995) used 18 climate variables to predict the response of Baird's Sparrows to climatic change. The two models used for Baird's Sparrows predicted completely opposite results, with one predicting extirpation and the other predicting a range expansion. The future of the Baird's Sparrow populations remain unclear and further work is needed.

Research priorities

1) Since reliable population data are unavailable, a two year range-wide survey, similar to that completed in North Dakota (Stewart and Kantrud 1972, Igl and Johnson 1997) is proposed. Baird's Sparrow nomadism complicates the survey design, but a two year range-wide survey should mitigate these effects.

2) A better understanding of the minimum preserve or patch size is important for the determination of priority habitats and areas for protection and restoration.

3) Little is known about the Baird's Sparrow's reproductive capability, habitat, and timing. There is little productivity data available; even less is known about survivorship. Currently, there are ongoing productivity studies in Saskatchewan (S.K. Davis and B.C. Dale), Montana (S. L. Jones and F. Prellwitz), and North Dakota (T. Grant and S.L. Jones), but more sites throughout the geographic range are necessary. Of special interest would be comparative studies on the reproductive success of Baird's Sparrows in different habitats: native and non-native grasslands, and cropland. Baird's Sparrow sing in croplands and fallow fields that might share critical structural characteristics with native prairie, but the productivity of these birds has not been investigated.

4) Further investigations on the response of Baird's Sparrows to different management techniques are needed. Current long-term studies in which data are being collected on population sizes, their distribution, and productivity are critical to the evaluation of the status of this species, but further work at different sites in their geographic range are needed.

5) The winter range and habitat use of the Baird's Sparrow needs to be documented. An inventory of wintering areas and an evaluation of their quality and security is needed to assess the influence winter areas are having on Baird's Sparrow populations.

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Appendix A:
State and Provincial Summaries of Baird's
Sparrow Status

APPENDIX A:
STATE AND PROVINCIAL SUMMARIES OF BAIRD’S SPARROW STATUS

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STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: ARIZONA

SUMMARY: Winter resident in the southeastern grasslands. Formerly much more numerous; described as abundant before 1878, and uncommon into the 1920's (Phillips et al. 1964). The species has been found west to the Altar Valley and north to Graham County. Records range from 16 August to 3 May.

BBS: N/A

CBC: Usually 1-2 reported per year. In 1982, heavy snowfall forced birds onto the roads and 22 were recorded on the Ramsey Canyon CBC and 25 on the Patagonia CBC (National Audubon Society 1983). Heavy snow also resulted in 33 individuals found on roadsides over a two-day period near Elgin in January 1997 (C. Gordon, pers. commun.).

ATLAS: N/A

RESEARCH/MONITORING: Numerous studies have been done in the past on habitat use and resource partitioning in southeast Arizona grassland birds (e.g. Bock et al. 1976; Bock et al. 1984; Bock et al. 1986; Pulliam and Mills 1977). In 1995, Caleb Gordon (U. of Arizona) initiated a study of the relationship between habitat patchiness and bird dispersal strategies, using winter movement patterns of grassland sparrows (including Baird's) as focal species. Thirty-six Baird's Sparrows were netted in winter 1995-1996 on the Audubon Research Ranch (ARR) at Elgin; 9 were netted at Buenos Aires National Wildlife Refuge at Sasabe during winter 1996-97. At ARR, only 16 were netted in 1996-1997 at the same plots with the same effort, showing a 56% between-year fluctuation in a local population (possibly related to rainfall). A 25% between-year recapture rate in those years shows a high winter site fidelity to 7-hectare plots. Radio-telemetry data on two individuals showed fixed home range use of about 2 hectares for up to 7 weeks in mid-winter (C. Gordon, pers. commun.).

MAJOR POPULATIONS: The primary known wintering areas currently are the grasslands, the Sonoita Plains, the San Rafael Valley, and the upper Altar Valley (Monson and Phillips 1981). The species is also detected occasionally in the Sulphur Springs Valley, and the regularity of occurrence in the Altar Valley is undetermined. The suitability of these areas for Baird's Sparrows may vary greatly between years depending on rainfall patterns.

STATE STATUS: Threatened

NATURAL HERITAGE RANK: S2N

HABITAT CONDITION: Generally prefers ungrazed to lightly grazed dense grasslands with low shrub cover. Pulliam and Mills (1977) found that *Ammodramus* sparrows, including Baird's, were most abundant in open grass >64 meters from shrub cover.

THREATS: Excessive grazing and residential development of grasslands are the major current impacts. Conversion of grassland to cropland probably not important in Arizona. Invasion of exotic grass (e.g. Lehman's Lovegrass *Eragrostis lehmanniana*) may actually increase the suitability of some grazed areas for Baird's Sparrows by providing necessary cover not otherwise present (C. Gordon, pers. commun.).

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Submitted by: Bill Howe, USFWS, Nongame Migratory Bird Coordinator, Region 2, P.O. Box 1306, Albuquerque, NM 87103. 505-248-6875; email: Bill_Howe@fws.gov

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: COLORADO, KANSAS, NEBRASKA, OKLAHOMA, WYOMING

SUMMARY: Regular migrant

BBS: N/A

CBC: N/A

ATLAS: N/A

RESEARCH/MONITORING: None

MAJOR POPULATIONS: None

STATE STATUS: No official designations.

CO: Casual fall migrant (4 records) and accidental spring migrant (2 records) on eastern plain. This species probably occurs as a regular migrant, but most observations undocumented or poorly documented (67 reports) (Andrews and Righter 1995).

KS: Baird's Sparrow is probably a rare transient with scattered reports statewide. Documented sightings: 25-28 April and 25 August to 7 October. Most sightings undocumented (Thompson and Ely 1992).

NE: Hypothetical in Pine Ridge area (Ducey 1991) with observations in Custer Co. (Korpi 1994) and Lancaster Co. (Eineman 1988).

OK: Rare and little-known migrant (Sutton 1967, Baumgartner & Baumgartner 1992). Roughly 7 documented records, but should be a regular migrant in the western part of the state. Timing: Spring: 12 April - 2 May; Fall: 9 October - 16 December (B. Howe).

WY: Baird's Sparrow is a uncommon migrant on the eastern edge, no documented breeding records; there are sightings of singing males found in the summer, occasional years (J. Bradley, A. Crevoski, O. Scott; Oakleaf et al. 1992).

NATURAL HERITAGE RANK: CO, KS: SZN; NE: SN; OK: SA; WY: S2?B?, SZN (M. Morrison, 1995, written commun.)

HABITAT CONDITION: Unknown

LITERATURE CITED:

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STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATES: ILLINOIS, IOWA, MISSOURI, UTAH, WISCONSIN

SUMMARY: Vagrant, casual, hypothetical, not breeding, not a regular migrant and not wintering in these states.

BBS: N/A

CBC: N/A

ATLAS: N/A

RESEARCH/MONITORING: None.

MAJOR POPULATIONS: None.

STATE STATUS: None.

NATURAL HERITAGE RANK: IL: SR; IA, MO, UT: SA; WI: SAN (M. Morrison 1995, written commun.)

HABITAT CONDITION: None.

NOTE: Also vagrant sightings in Ohio (Robbins 1991), New York, California, Maryland (DeSante & Pyle 1986), West Virginia (Breiding 1985), Ontario (Lemey 1981), and British Columbia (Kautesk 1982).

LITERATURE CITED:

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STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: MINNESOTA

SUMMARY: Rare but regular breeder in the state, no reliable estimate of population available.

BBS: N/A

CBC: N/A

ATLAS: N/A

RESEARCH/MONITORING: None, unknown.

MAJOR POPULATIONS: Red River Valley, Grand Forks County. Historically breeds in northwestern Minnesota, but probably always limited to the Red River Valley area from northern Traverse to Kittson counties (Janssen 1987). Common breeder in this area in the 1920's when the Bell Museum conducted surveys, where it was endemic to a limited geographic area in northwest Minnesota. Surveys conducted in the 1960's found Baird's Sparrow breeding in reduced numbers and populations had declined; the species can be irruptive and very variable over years (Coffin and Pfannmuller 1988).

COMMENTS: Also documented in Roseau County (Bardon 1991), Crow Wing County (Risen 1986) and Clay County (Eckert 1993; Risen 1991).

STATE STATUS: Breeder, Endangered

NATURAL HERITAGE RANK: S1 (M. Morrison 1995, written commun.)

HABITAT CONDITION: Poor and limited; remnant native prairie.

THREATS: Conversion of prairie to agriculture and development. Agriculture has eliminated most of the historical habitat.

LITERATURE CITED:

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Submitted by: Stephanie Jones, USFWS Region 6, Denver, CO and Steve J. Lewis, USFWS, Region 3, Minneapolis, MN.

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: MONTANA

SUMMARY: Regular Breeder (Figure A1), no estimate of population available.

BBS: 1966-1996: +1.0%, n=19 routes, non-significant (Sauer, et al. 1996)

CBC: No records.

ATLAS: None for state; quarter Latilong (½ degree blocks of latitude and longitude) study available (Ellis et al. 1996).

RESEARCH/MONITORING:

Benton Lake National Wildlife Refuge: Grassland bird surveys in 1995 found limited numbers of singing males on Benton Lake NWR and associated WPAs. Contact: Steve Martin, Benton Lake National Wildlife Refuge, PO Box 4501, Black Eagle, MT 59414

Bowdoin National Wildlife Refuge: Second year with 4 plots established for productivity, includes point counts. Contact: Fritz Prellwitz, Bowdoin National Wildlife Refuge, HC 65, Box 5700, Malta, MT 59538; Stephanie Jones, USFWS, P.O. Box 25486 DFC, Denver, CO 80225 and Geoff Geupel, PRBO, 4990 Shoreline Hwy., Stinson Beach, CA 94970-9701

Medicine Lake National Wildlife Refuge: About 90 line transects and point counts are done covering about 100 m by 100 m areas of both native and tame prairie habitats. Contact: Mike Rabenberg, U.S. Fish and Wildlife Service, Medicine Lake National Wildlife Refuge, 223 N. Shore Road, Medicine Lake, MT 59247-9600

BLM: In cooperation with Bowdoin National Wildlife Refuge 6 BLM sites previously surveyed in 1979-80 are being re-surveyed. Contacts: Michelle Williams, BLM - Lewistown District Office, 80 Airport Road, Lewistown, MT 59457; Fritz Prellwitz, Bowdoin National Wildlife Refuge, HC 65, Box 5700, Malta, MT 59538

Montana Natural Heritage Program: Collected all known locations for Baird's Sparrows in Montana and developed a database and GIS interface for mapping Baird's Sparrow locations (Figure A1) and will continue to record and map additional locations and surveys of currently known locations. Contact: below.

MAJOR POPULATIONS: Highest numbers so far appear to be in the northeast corner of the state, particularly Sheridan County. Figure A1 represents all known locations including BBS surveys, research reports, and reports by individuals. Indications are that reasonable populations exist along the northern 1/3 of Montana decreasing somewhat as you move from east to west; status is less clear in along the eastern 25% of the state and at scattered

locations in the south-central part of Montana from the Missouri River to the Wyoming border. The two sightings in Missoula County were late spring reports, presumably migrants.

STATE STATUS: Species of Special Interest or Concern (D. Flath written commun.)

NATURAL HERITAGE RANK: S3S4B, SZN (M. Morrison, written commun.)

HABITAT CONDITION: Unknown

THREATS: Unknown, thought to be conversion of grassland to agriculture, haying and high levels of grazing.

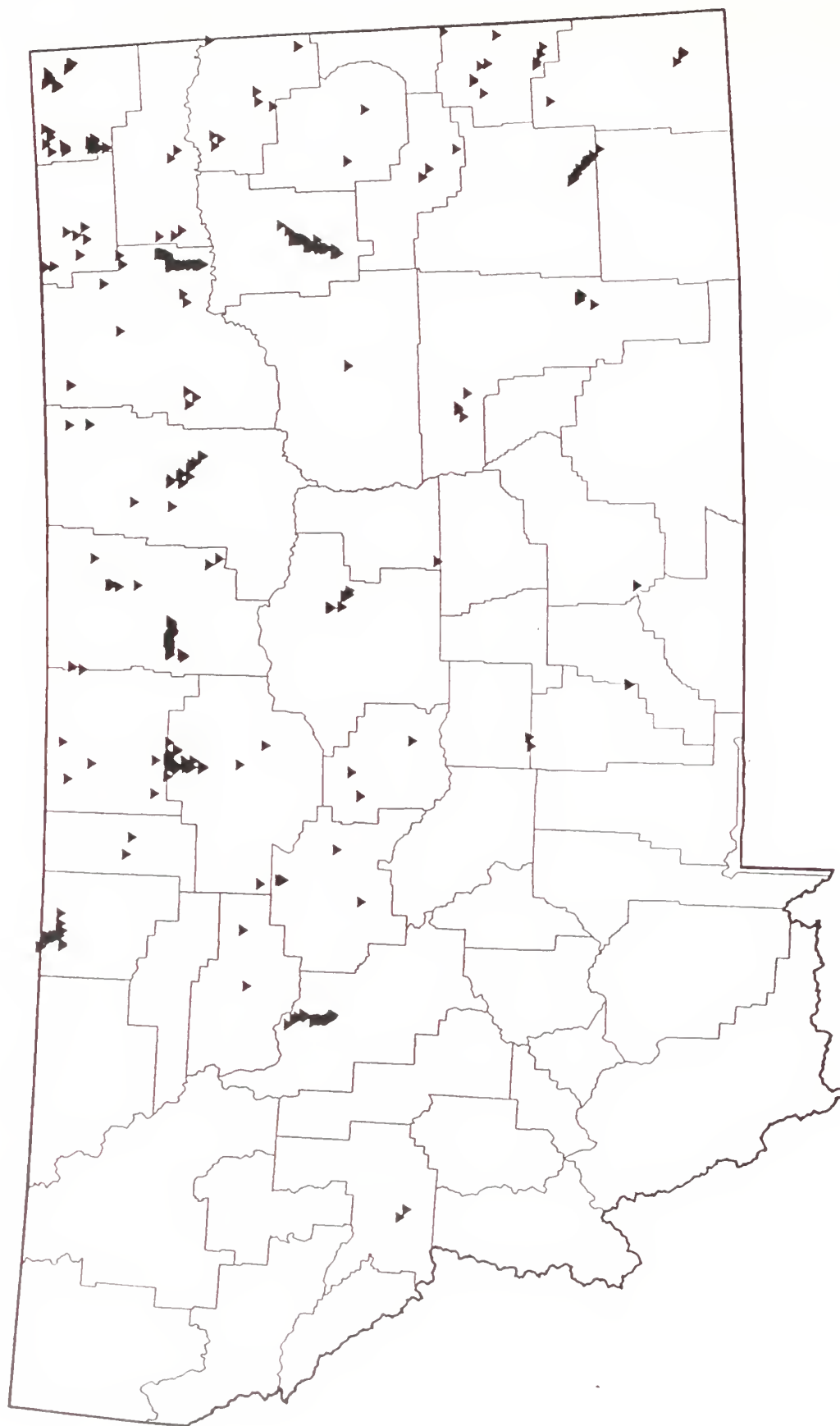
LITERATURE CITED:

Ellis, J., C. Jones, D. L. Genter, J. Reichel, B. Spettigue, and D. Sullivan. 1996. P.D. Skaar's Montana Bird Distribution, Fifth Edition. Special Pub. 3, Montana Natural Heritage Program, Helena.

Sauer, J.R., S. Schwartz, B.G. Peterjohn, and J.E. Hines. 1996. The North American Breeding Bird Survey Home Page. Version 94.3, Patuxent Wildlife Research Center, Laurel, MD.

Submitted by: Jim Reichel (deceased)

Contact: Montana Natural Heritage Program, P.O. Box 201800, Helena, MT 59620-1800, phone: 406-444-2546.



MONTANA

Figure A1. Baird's Sparrow (*Ammodramus bairdii*) distribution in Montana. Locations from Montana Natural Heritage Program (January, 1996).

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: NEW MEXICO

SUMMARY: Rare but probably regular migrant, eastern plains and southern lowlands. Recent records are from Hidalgo, Luna, and Union counties (New Mexico Department of Game and Fish 1988), Socorro County (National Audubon Society 1977) and Otero County (R. Meyer, pers. commun.). Only three winter records (1 specimen and two recent sight records), but the species may occur regularly in winter on the Otero Mesa and in Hidalgo County. The vast majority of records are in fall. Formerly much more numerous and widespread in New Mexico. According to Bailey (1928), Henshaw (in the 1870's) found Baird's sparrows "in immense numbers...throughout the rolling plains along the bases of the mountains, and even quite high up among the foothills." Timing: Fall: 4 August to 23 November; Winter: 13 January 1929 at Roswell (specimen; Hubbard 1978) and sight records on the Otero Mesa 4 January 1997 and 21 February 1997 (R. Meyer, pers. commun.); Spring: early March to 29 April, possibly to mid-May

BBS: N/A.

CBC: 3 were reported on the Peloncillo Mts. CBC on 28 December 1987, but the report was not well supported by detail. All subsequent CBCs reported Grasshopper Sparrows but no Baird's Sparrows.

ATLAS: N/A.

RESEARCH/MONITORING: No research under way. Grassland bird surveys with an emphasis on Baird's Sparrows are being conducted by various entities in southern New Mexico, particularly in the vicinity of White Sands Missile Range and Fort Bliss Military Reservation.

MAJOR POPULATIONS: None known. Found most consistently in the Animas Valley, Hidalgo County, and very recently in both migration and winter on the Otero Mesa, Fort Bliss Military Reservation, Otero County (Ligon 1961).

STATE STATUS: Threatened. Also listed as a species of concern by New Mexico "Partners in Flight" (Mehlman and Williams 1995).

NATURAL HERITAGE RANK: S2N

HABITAT CONDITION: Found primarily in grasslands at elevations of 4000 feet to 5000 feet, but historically has also been located in mountain meadows at elevations up to 12,000 feet. In grazed areas tends to occur in swales with higher grass, or along ungrazed roadside edges. To improve its status, range improvement practices are needed to leave more cover for the sparrows and allow for greater production of grass seeds (New Mexico Department of Game and Fish 1988).

THREATS: Excessive grazing; conversion of grasslands for agricultural purposes. Unknown is the risk to migrants of spraying of pesticides and herbicides in and around grasslands.

LITERATURE CITED:

- Bailey, F. M. 1928. Birds of New Mexico. N. Mex. Dept. Game and Fish. 807 pp.
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- New Mexico Department of Game and Fish. 1988. Handbook of species endangered in New Mexico, F-150:1-2.

Submitted by: Bill Howe, USFWS, Nongame Migratory Bird Coordinator, Region 2, P.O. Box 1306, Albuquerque, New Mexico 87103 505-248-6875; email: Bill_Howe@fws.gov

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: NORTH DAKOTA

SUMMARY: Regular Breeder (Figure A2); state population estimated as 171,000-279,000 pairs (range 90,000-418,000) (Igl and Johnson 1997).

BBS: There was a significant ($P < 0.01$), decreasing population trend in North Dakota during 1966-79. Trends during 1980-94 and 1966-94 were negative but not significant. They were detected on 50% of 46 Breeding Bird Survey (BBS) routes in the state during 1966-79 (Sauer et al. 1996). During 1966-95 Baird's Sparrows were on 75% of 44 routes and on average (Figure A3), they were detected at < 1 stop/route/year on nearly one-third of routes. When 1966-93 BBS data for the mid-continent region were divided into broad physiographic provinces or strata Baird's Sparrow exhibited a positive though statistically insignificant trend in the "Glaciated Missouri Plateau", most data for this strata were from North Dakota.

CBC: No records

ATLAS: N/A; Stewart (1975) is considered to have similar data on the breeding birds of North Dakota (Figure A2).

RESEARCH/MONITORING: (location references are on Figure A4). Arrowwood NWR (south central). Baird's Sparrow suspected to be "common" breeding species, but not found on preliminary breeding bird surveys during 1994-95. Arrowwood is near the southern margin of the breeding range and much of the upland prairie is in poor condition, dominated by smooth brome (*Bromus inermis*), leafy spurge (*Euphorbia esula*), and western snowberry (*Symphoricarpos occidentalis*). Contact: Paulette Scheer, Arrowwood NWR.

Audubon NWR Complex (central): No Baird's Sparrows were detected at 51 point count plots during a survey in 1994. They were found on 3 of the 4 Waterfowl Production Areas in 1995 and comprised slightly less than 1% of 4272 total bird detections overall. Contact: C. Hultberg, Audubon NWR

Des Lacs NWR (northwestern). In 1994, Baird's Sparrow were detected on 1% of 300 point count plots in native prairie and other grass-dominated habitats (R. Murphy, unpubl. data).

J. Clark Salyer NWR (north central). Baird's Sparrows were on 11 of 86 point count plots in 1995. Large grassland blocks interspersed with small clumps of aspen did not have Baird's Sparrows. Shrub cover was absent or sparse where they were found. Contact: Todd Grant, J. Clark Salyer NWR.

Lostwood NWR (northwestern). Several projects conducted independently since 1979 all point to markedly increased Baird's Sparrow abundance following prescribed burning of idle, native mixed grass prairie, and indicate they are absent or rare in prairie with a history of rest and resulting woody invasion. Lostwood NWR has hosted three large studies of Baird's Sparrow: Green (1972), Winter (1994) and Madden (1996). Madden (1996) found Baird's Sparrow abundance

correlated negatively (all $P < 0.05$ to < 0.001) with shrub cover, Robel visual obstruction, and vegetation density; positively with grass cover, percent live vegetation, and forb cover. Abundance correlated with several plant species associations: negatively with frequency of snowberry/silverberry shrubs, positively with frequencies of native grasses and Kentucky bluegrass/native grasses. These studies are summarized in Appendix B.

R. Murphy and A. Kruse (in prep.) completed a 10-year study of effects of prescribed burning and livestock grazing on abundance of breeding birds on native mixed grass prairie in Lostwood (3 replicates of each treatment, 0.8 km Emlen transect/replicate). Comparing mean relative abundance between pre-treatment years (1980-81) and post-treatment years (1987-89), Baird's Sparrows increased from 0 to 12.5 singing males/40 ha on areas burned and decreased slightly from 4.2 to 2.5 on idle/control areas. Their abundance did not change on grazed and burn/graze treatments (means, 0.8 vs. 0.8 and 4.2 vs. 5.0). Contact: R. Murphy, Des Lacs NWR or Karen Smith, Lostwood NWR.

Chase Lake Prairie Project (southcentral). In northwestern Kidder County during 1995, Baird's Sparrows were detected on 18% of 57 point count plots (100-m radius) scattered among five (3-5 km² each) privately-owned, native prairie tracts managed by twice-over deferred grazing regimes. Contact: R. Murphy, Des Lacs NWR.

North American Waterfowl Management Plan-Prairie Pothole Joint Venture Northern Coteau Project (northwestern). In northern Mountrail County during 1995, Baird's Sparrows were detected on 67% of 109 point count plots (100-m radius) distributed among 5 treatment-control pairs: treatments consisted of roughly 3 km² native prairie tracts managed by twice-over, deferred grazing; controls were various grazing leases on state school section lands, generally season-long. They comprised 12.6% of 1119 singing birds detected within plots on all point counts. There was no apparent difference in abundance or frequency of Baird's Sparrows between grazing systems and state land leases, and no clear relationship between grazing history and their abundance (R. Murphy, unpubl. data).

Upper Souris NWR (north central). Baird's Sparrows were detected on 6.1% of 114 point count plots (50 m radius) in 1994 and 14.5% of 124 plots in 1995. Contact: Duane Anderson, Upper Sorris NWR.

USDI-National Biological Service Northern Prairie Science Center. In response to prescribed burning, Baird's Sparrow abundance was relatively low during 1-2 years post-burn, but increased and peaked 3-4 years following burning (data weak for Baird's Sparrows, they were uncommon on the study area). Contact: Doug Johnson, USGS/BRD, NPWRC, Jamestown, ND

USDA-Forest Service Little Missouri River National Grasslands (covers much of counties in west central North Dakota especially McKenzie, Golden Valley, Slope, Billings, Dunn), includes USDI-National Park Service Theodore Roosevelt NP (2 main units; west central). Monitoring of breeding bird communities via point counts initiated in 1994. One to 4 permanent transects, 10 point count stations each (200 m radius), are established per 7.5-min topographic quad. Roughly 75% of the points are in grasslands. In 1994, Baird's Sparrows were detected on 6% of 800 point counts (80 transects) widely scattered across the Little Missouri River National Grasslands of southwestern North Dakota.

The Nature Conservancy - Cross Ranch Nature Preserve (central). They have monitored breeding birds by the flush-map method (Weins 1969) since 1992. General increase in Baird's Sparrow observed since 1992. They have observed about 3.3 males/40 ha on 243 ha of grassland in "silty" range site, but none on 3 other range sites or on silty sites where bison were grazing. Contact: A. Schollet.

National Audubon Society - Spiritwood Sanctuary (south central). No records of Baird's Sparrow on this ca. 6 km² area on the Drift Plain in central Kidder County, the apparent eastern edge of breeding range in North Dakota; there is a lack of native prairie in area. Contact: B. Barbour.

MAJOR POPULATIONS: Historical population levels are unknown, although several references indicate Baird's Sparrow were a common species in presettlement North Dakota. For example, in 1873 Coues (1878) noted Baird's Sparrows as one of the most abundant passerines from the Souris River Plain west to the Missouri Coteau. Historically, there was 140,000 km² of mixed grass prairie in North Dakota (Samson and Knopf 1994). If one-third of this area annually lacked Baird's Sparrows due to fire, heavy bison grazing, drought, or other major disturbances, and a nominal density of 5 pairs/40 ha occurred on the remaining prairie, a conservative estimate of the historic population size in the state is 1.2 million pairs.

Major populations of Baird's Sparrows occur on (1) the Missouri Coteau of Kidder County nearly in central North Dakota, (2) the Coteau of northwestern North Dakota and some adjacent Drift Plain and Coteau Slope, and (3) on part of the northwestern Drift Plain of north central North Dakota, especially the Souris River Plain of McHenry County (Stewart 1975, Martin and Berkey pers. comm.). West of the Missouri River, Baird's Sparrows were detected on only 16 of 59 quarter section plots in 1976 (Seabloom et al. 1978). These general patterns are roughly corroborated by BBS data (Figure A3). The Coteau and Coteau Slope were principal subregions for Baird's Sparrow in Stewart and Kantrud's (1972) original statewide survey.

STATE STATUS: None; there is no official State list of endangered and threatened species. In a 1986 list of endangered and threatened biota compiled by the North Dakota Chapter of the Wildlife Society, Baird's Sparrow was considered a "Watch" species: problems with abundance or distribution are suspected but unconfirmed and current status of the species needs further study (Anonymous 1986). This list tends to be recognized as a state list.

NATURAL HERITAGE RANK: (G3) SU (it is possibly in peril in the state but its status is uncertain and additional information is needed to make a determination) (M. Morrison, 1995 written commun.).

HABITAT CONDITION: Mixed grass prairie comprised about 140,000 km² of North Dakota historically (Samson and Knopf 1994), nearly three-fourths of the state's land area. More than 100,000 km² or 71% of this prairie resource has been lost due almost entirely to cultivation. The quality of remaining native mixed grass prairie tracts for Baird's Sparrow has declined due to fragmentation, alien and exotic species invasions, changed grazing patterns, and altered succession from loss of recurrent fire with which Baird's Sparrow coevolved (Knopf 1994). For example, parts of northwestern North Dakota transformed from mixed grass prairie to aspen parkland in the

absence of recurrent fire (Murphy 1993). Baird's Sparrow occurs at high densities, but only in areas treated by repeated prescribed burning (Madden, 1996, R. Murphy, unpubl. data.).

Under the Conservation Reserve Program (CRP) nearly 13,000 km² of herbaceous cover in North Dakota was seeded on croplands with tame grass or tame grass/legume mixtures (Johnson and Igl 1995). CRP has contributed little habitat for Baird's Sparrow since most cover currently being reseeded under this program is tame grass or tame grass/legume mixtures, which tend to be too tall and dense for Baird's Sparrow (Johnson and Schwartz 1993, Johnson and Igl 1995).

THREATS: More than 100,000 km² or 71% of the prairie resource has been lost due almost entirely to cultivation. This destruction continues nearly unabated; 6% of North Dakota prairie was lost during 1982-92 (Anonymous 1994). Several million ha of native prairie have medium to high potential for conversion to cropland (Hexem and Krupa 1987); the demand from the world market for the export of grains is one factor that could hasten this conversion. The Sodbuster provision of the 1985 Food Security Act, designed to deter breaking of prairie on highly erodible lands, has been ineffective in stemming such losses in North Dakota. Converting cropland to perennial, herbaceous cover inadequately mitigates loss of native prairie habitat for Baird's Sparrows since CRP in North Dakota is unsuitable for Baird's Sparrows, although it is used by other grassland species.

Invasion by two exotics, leafy spurge and smooth brome, may represent the most insidious, serious, and widespread threat to remaining Baird's Sparrow breeding habitat in North Dakota. Brome was widely introduced to northern prairies nearly a century ago primarily as a forage species and roadside cover (Romo and Grilz 1990). It is invasive, develops monotypic stands, and is persistent under all range management regimes except perhaps annual, season-long grazing. On Lostwood NWR, brome and other broad-leaved, exotic grasses were significantly less common in areas occupied by Baird's Sparrows compared to unoccupied areas (Madden 1996). Smooth brome is codominant and increasing in mixed grass prairie of North Dakota on at least the northern and central Missouri Coteau and much of the northwestern Drift Plain. On xeric, sandy soils it is much less readily established and less able to compete with native, herbaceous flora.

Currently, leafy spurge infests about 6% of native prairie and other untilled uplands in North Dakota (Leitch et al. 1994). The total state area affected by spurge doubled each decade since the 1960s (Wallace et al. 1992). Spurge is particularly problematic on refuges and other lands dedicated to wildlife where these areas lack the financial resources and personnel to combat it. About 7% of "wildland" areas in North Dakota are infested with spurge (Leitch et al. 1994). However, recent advances in bio-control show promise in controlling leafy spurge (M. Green, pers. comm.).

In North Dakota, idle native prairie can gradually become dominated by western snowberry, which can create monotypic stands and conditions that make the habitat unsuitable for Baird's Sparrows. Management of native prairie using fire and other methods can be used to control western snowberry.

In addition to tillage and exotic plant threats, current land management practices on native prairie in North Dakota may also pose threats to Baird's Sparrows. This is particularly true on

publicly-owned prairie tracts, which appear to be either grazed too heavily and frequently for Baird's Sparrows, or rested so long that woody vegetation invades and litter depths become excessive. Improved knowledge of Baird's Sparrow habitat requirements on a landscape scale could resolve conservation problems in these areas.

The current population status of Baird's Sparrow in North Dakota is uncertain. Threats to native prairie in North Dakota place it at risk and should be clearly quantified and trends and impacts projected. Available survey data weakly suggest the state breeding population is slightly declining or stable. Almost no reproductive data are available from North Dakota. These data would aid in assessments of habitat suitability, and in gauging the effects of changes in habitat use or habitat modifications.

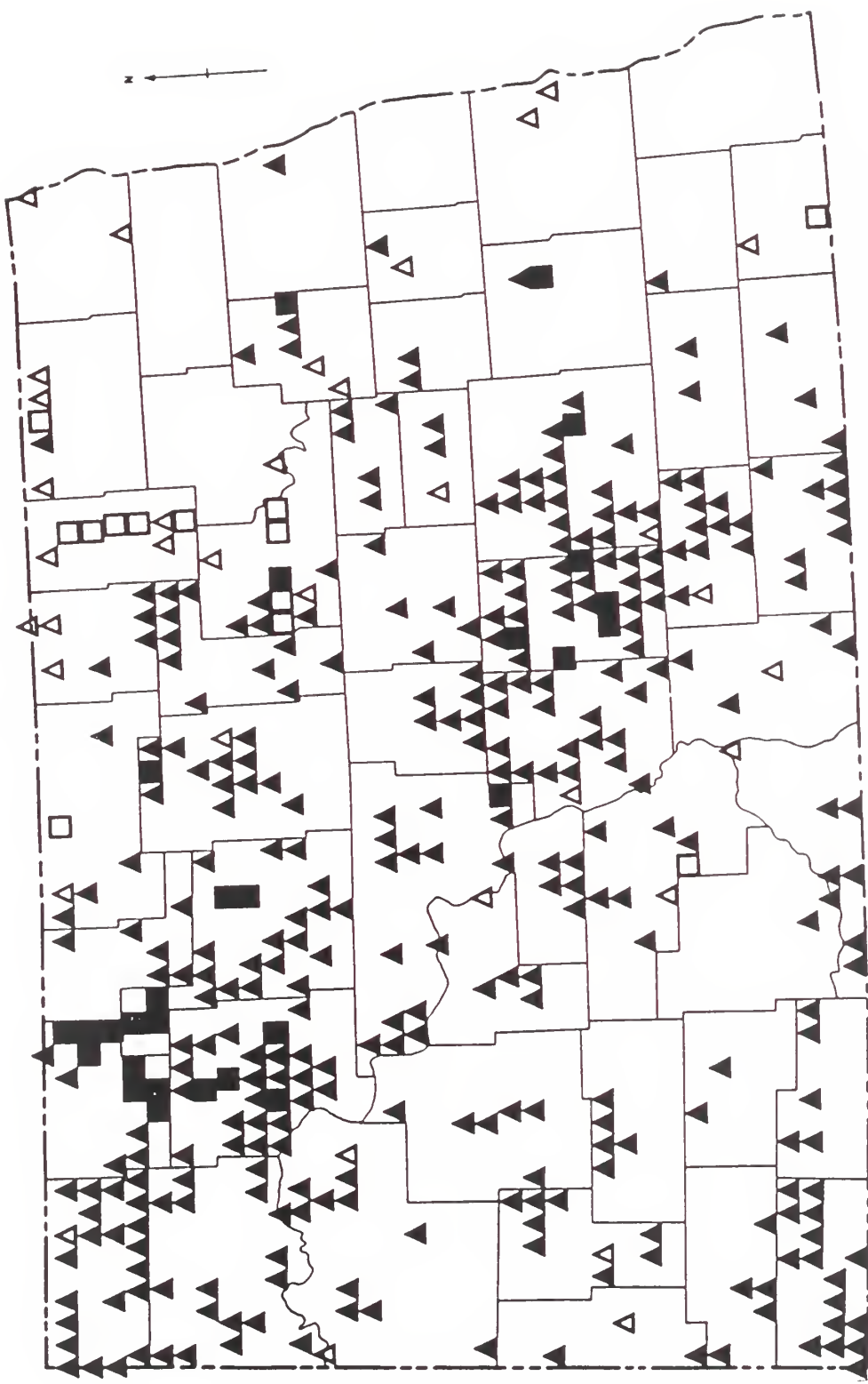
In conclusion, the quality and quantity of native mixed grass prairie that serves as Baird's Sparrow habitat in North Dakota will continue to decline mainly due to conversion to agriculture, fragmentation, invasion by exotic plants, and generally inappropriate management of public grasslands. Collectively, these factors probably reduce availability of Baird's breeding habitat by at least 1% annually.

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Submitted by; Robert Murphy, USFWS, Des Laes NWR Complex, Box 578, Kenmare, ND 58746. 701-385-4046 email: Robert_Murphy@fws.gov



MAP SYMBOLS

- Nests or dependent young recorded from 1950 through 1972
- Nests or dependent young recorded prior to 1950
- ▲ Territorial males or pairs recorded from 1950 through 1972
- △ Territorial males or pairs recorded prior to 1950

NORTH DAKOTA

Figure A2. Baird's Sparrow (*Ammodramus bairdii*) distribution in North Dakota. Locations from Breeding Birds of North Dakota (Stewart 1975).

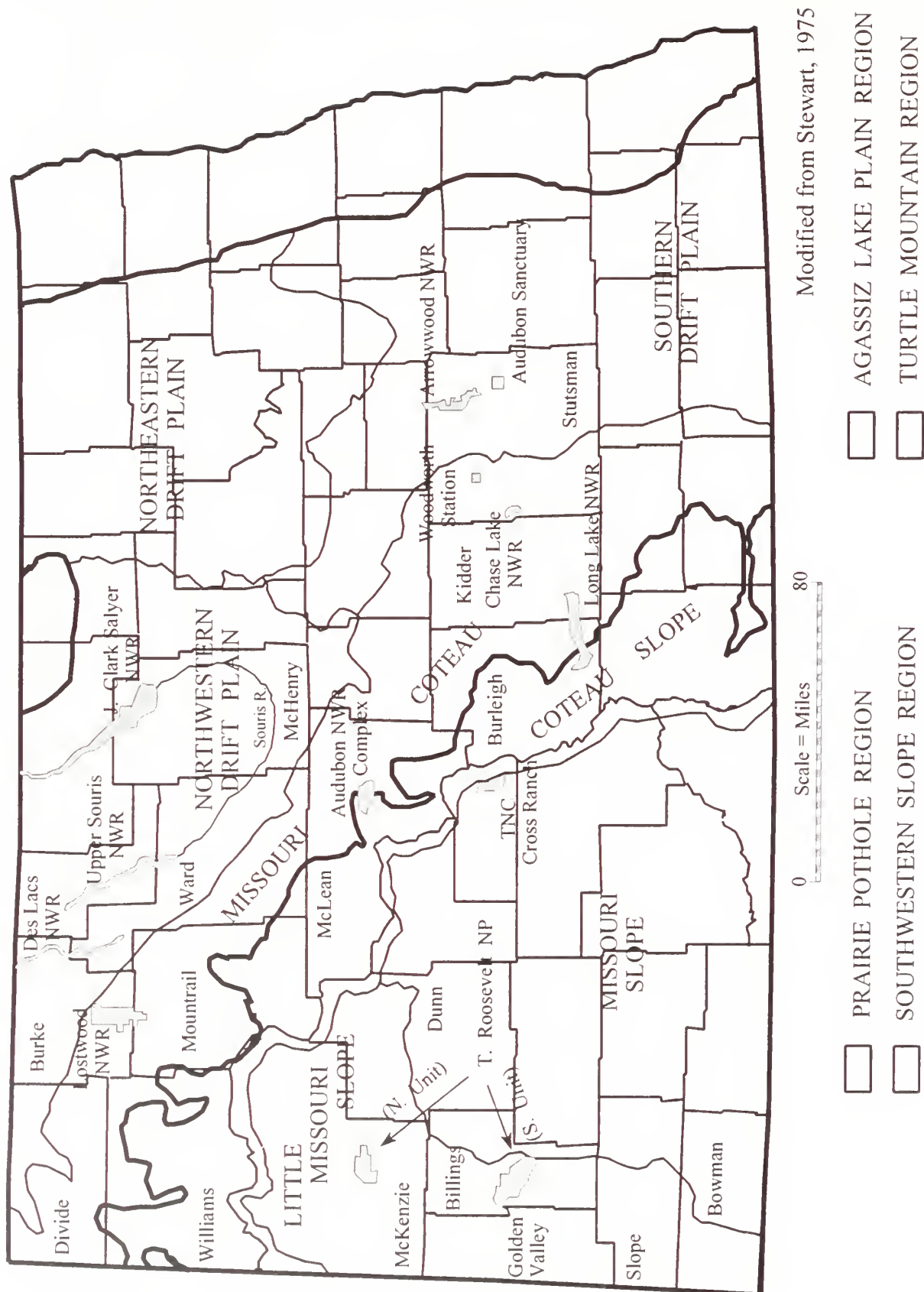


Figure A3. Biotic areas of North Dakota, and place names mentioned in text.

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: SOUTH DAKOTA

SUMMARY: Regular Breeder (Figure A5); no reliable population estimate is currently available.

BBS: Baird's Sparrow detected on only 4 routes during 1966-1994; the sample size for South Dakota is too small for trend analysis (Sauer, et al. 1996).

CBC: No records.

ATLAS: The South Dakota Breeding Bird Atlas (Peterson 1995) documented occurrence as uncommon and local. All detections were in the northern or central (Kantrud and Faanes 1979) portion of the state. No nests were reported during the Atlas period (1988-1993), but previous dates for nests with eggs are 13 June to 24 July.

RESEARCH/MONITORING: Little work in South Dakota, partially due to the limited range and breeding population. Some local monitoring has occurred, but this has not been long-term or consistently completed. S. H. Ordway Prairie Reserve (TNC) did a unpublished limited assessment in 1985 (B. Harris & D. Backlund, written commun.). Breeding bird surveys on the Grand River National Grassland detected some Baird's Sparrow (D. Griffith, pers commun. 1996)

MAJOR POPULATIONS: Northwest and northcentral, occurring in about 5.9% of the state (SDOU 1991; Peterson 1995); 21 reports during the Atlas period in Butte, Plains, Cheyenne, Divide, Oahe and Pothole Atlas regions (Peterson 1995; Figure A5).

STATE STATUS: (G3) S2B, SZN (E. Stukel, 1994, written commun.)

NATURAL HERITAGE RANK: S2B, SZN (M. Morrison, 1995, written commun.)

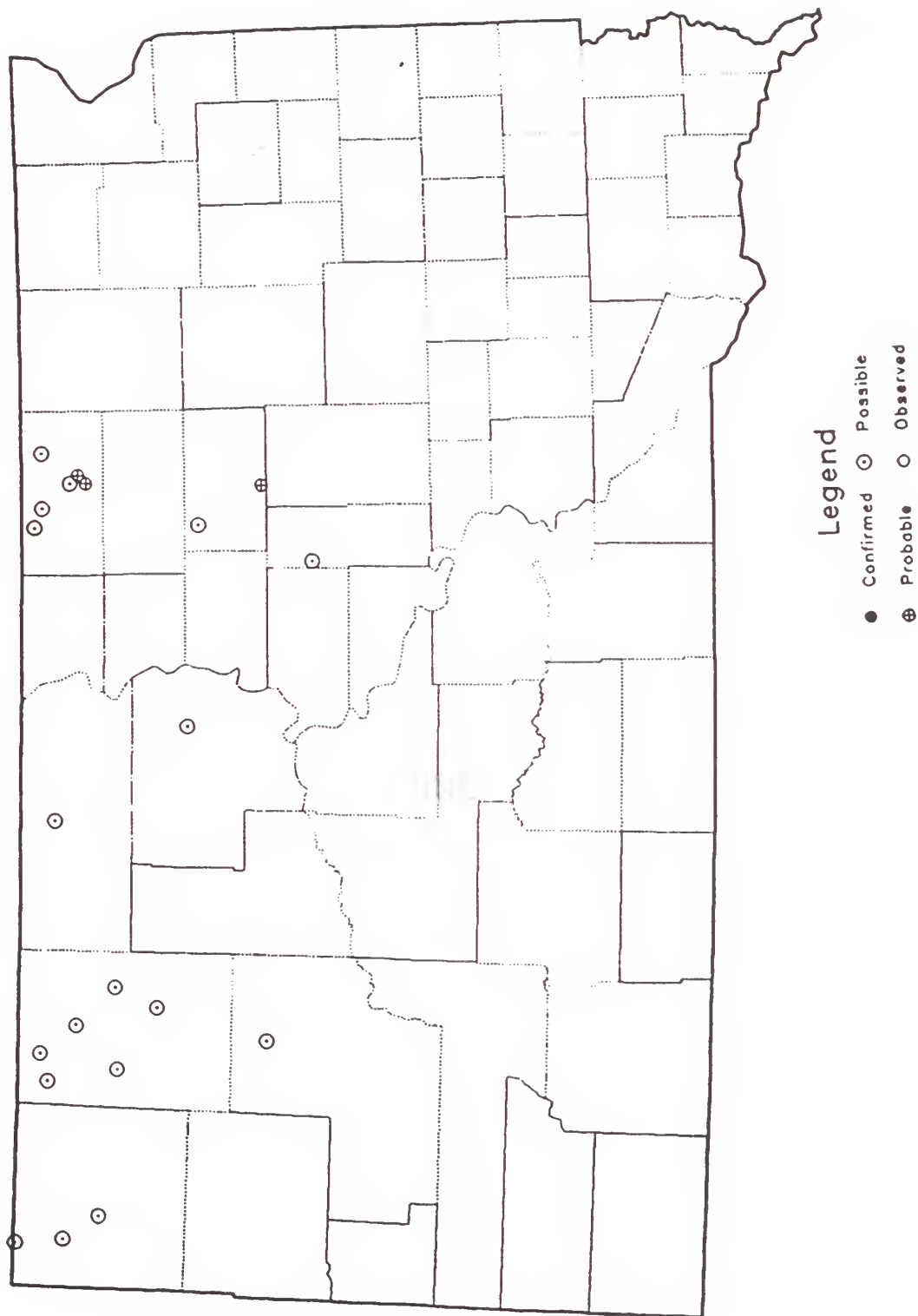
HABITAT CONDITION: Unknown, with 76.2% of the sightings from the Atlas period in native grass (Peterson 1995); limited detections in grazed and other disturbed habitats. Loss of mixed grass prairie breeding habitat in South Dakota not clearly quantified.

THREATS: Unknown, but thought to be habitat destruction mainly from conversion of native prairie to cropland. One record of a nest with 2 Brown-headed Cowbird eggs (Peterson 1995).

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Submitted by Stephanie Jones, USFWS Denver, CO and Robert Murphy, USFWS, Des Lacs NWR, Kenmare, North Dakota. May, 1995.



SOUTH DAKOTA
 Figure A5. Baird's Sparrow (*Ammodramus bairdii*) distribution in South Dakota. Locations from South Dakota Breeding Bird Atlas (Peterson 1993).

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE: TEXAS

SUMMARY: Winter resident in the western half of the state east to Bexar County. Rare migrant. There are 11 documented records from Bexar, Hidalgo, Hudspeth, Jeff Davis, Presidio, and Tom Green counties, and over 100 undocumented reports in the state (Texas Ornithol. Soc. 1995). The species is certainly more numerous in the grasslands of the Trans-Pecos region than the few records would indicate, but most of what would be considered "good" Baird's Sparrow habitat is not accessible to the public. Winter records are also primarily from the Trans-Pecos region. Formerly probably much more numerous in Texas, as elsewhere. Verified records range from 29 October to 11 May. Unverified reports range from 8 August to 25 May

BBS: N/A

CBC: Recorded on 23 CBCs nearly statewide. The trend is highly significantly negative (-1.7%/yr; $P < 0.01$). Virtually all CBC records are unverified, undetailed, and of questionable validity, so distribution and trends calculated from these data are unreliable.

ATLAS: N/A

RESEARCH/MONITORING: None

MAJOR POPULATIONS: Over 70% of all records have come from the Marfa-Valentine grasslands in the Trans-Pecos region (G. Lasley, pers. commun.).

STATE STATUS: Not Listed

NATURAL HERITAGE RANK: S2

HABITAT CONDITION: Grasslands at 4500-5500 feet elevation are the primary locations of sightings/specimens. Habitat conditions are unquantified.

THREATS: As in other parts of the Southwest, heavy grazing and conversion of grasslands to other "habitats" are the primary threats to this species.

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Submitted by: Bill Howe, USFWS, Nongame Migratory Bird Coordinator, Region 2, P.O. Box 1306, Albuquerque, NM 87103. 505-248-6875; email: Bill_Howe@fws.gov

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

PROVINCE: ALBERTA

SUMMARY: Regular Breeder, population estimated at 18,600 individuals (9,300 males) (Wershler in prep).

BBS: Population trends are non-significantly negative for all periods analysed: 1966-1994 (-0.4), 1966-1979 (-7.9) and 1980-1994 (-0.9) (Sauer et al. 1996).

CBC: No records.

ATLAS: Fieldwork for the Alberta bird atlas (Semenchuk 1992), carried out during 1987-1991, confirmed the sparrow's preference for the grassland habitat of southeastern Alberta. About 84% of the 134 squares (one square = 10 km x 10 km) in which Baird's Sparrows occurred were located in the grassland biome. The remaining squares where Baird's Sparrows were found were in the Aspen Parkland (about 15%) and the Boreal Forest (approximately 1%) regions. Eleven of the 12 squares in which confirmed breeding records occurred for the province were in the Alberta's grasslands biome. The remaining square where breeding occurred was from the Aspen Parkland region but the record occurred very near to the grassland biome.

RESEARCH/MONITORING: A draft status report (Wershler 1990) and a draft provincial management plan (Wershler 1992) have been prepared. BBS surveys have been carried out for 30 years (1966-1995). Other monitoring has been carried out by C. Wershler (unpubl. data). Research on the species in Alberta has included the effect of agriculture on Baird's Sparrows (Owens 1971 cited in Wershler 1992, Owens and Myres 1973), detectability (Mahon 1995), habitat selection (Mahon 1995, D. Prescott and B. Goddard, unpubl. data), census techniques (Bartlett 1991), effect of pesticides on Baird's Sparrow productivity (Martin 1994), abundance and productivity in cultivated lands (Forsyth and Martin 1995), grazing effects (Prescott et al. 1993, Prescott and Wagner 1996) abundance, habitat preference and grazing effects (B. Dale and J. P. Goossen, unpubl. Canadian Wildlife Service data).

MAJOR POPULATIONS: Wershler (1992) lists the following eight primary breeding habitats in Alberta whose importance is not necessarily based on high populations of Baird's Sparrows:

- Kennedy Creek-Lost River
- Cypress Hills
- Little Fish Lake
- Chain Lakes-Dowling Lake
- Milk River Ridge
- Sullivan Lake-Halkirk-Castor
- Gough Lake-Shooting Lake
- Many Island Lake-Red Deer Lake.

Wershler (1990) carried out singing male surveys in 1989 and estimated the Alberta male Baird's Sparrow population to be 9,300+. This estimate is considered to be a very conservative and rough number (Wershler, In prep.).

PROVINCIAL STATUS: The Baird's Sparrow is on Alberta's Red List but not as an endangered species (Alberta Forestry, Lands and Wildlife 1991). A species on the Red List is considered to be "in serious trouble. Their populations are nonviable or at immediate risk of declining to nonviable levels in Alberta. They have, or will be considered for, designation as Endangered Species in Alberta." A revised status report on Alberta's wildlife is currently being prepared.

NATURAL HERITAGE RANK: Preliminary rank assignment: S4B (J. Gould, pers. comm.)

HABITAT CONDITION: Coupland (1987), using Mixed Prairie Census Districts to determine rangeland ("other unimproved land") loss in Alberta found that rangeland declined from 53% to 41% during 1956 to 1981. Declines in fescue prairie were 40% to 31% for the same period. Grazing pressure during 1956-1976 increased about 47% and 29% for mixed prairie and fescue grassland, respectively. Annual steer and heifer production (1990-2000) is projected to increase by over 50% and pasture/native range capacity from 110% to 160-180% (Alberta Agriculture Market Analysis Branch pers. comm. to G. Trottier, Canadian Wildlife Service).

THREATS: Conversion of grasslands to agriculture, including haying, croplands and the resulting fragmentation, and increased grazing rates. Increased irrigation allows the conversion of native grasslands into croplands.

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- Submitted by: J. PAUL GOOSSEN, CANADIAN WILDLIFE SERVICE, 4999-98th Ave., Edmonton, Alberta, Canada T6B 2X3. 403-951-8678, email: paul.goossen@EC.gc.ca
26 February 1996

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

PROVINCE: MANITOBA

SUMMARY: Regular breeder, estimated population 3,400 (1,700/pairs). (De Smet 1992)

BBS: The Baird's Sparrow is not well represented on the BBS in Manitoba occurring irregularly and infrequently on a handful of routes in southwestern Manitoba. Until 1989 it had been found on five routes in the province with an average of only 0.37/route. A new route created in extreme southwestern Manitoba in 1995 (Elva) shows potential for future monitoring as 23 Baird's Sparrows were recorded on it.

CBC: No records.

ATLAS: No data, in process.

RESEARCH/MONITORING: In Manitoba during the 1930's, Cartwright et al. (1937) conducted the first major ecological study of Baird's Sparrow.

Surveys by Natural Resources, Wildlife, in Manitoba have been ongoing since 1985 (see Ratcliff 1987; De Smet and Conrad 1989, 1991; De Smet 1991, 1992, 1994). Since 1985, the species has been recorded in 809 locations in the province--over three-quarters of these are in the extreme southwest (south and west of Oak Lake). The largest influx occurred during 1988, when 460 Baird's Sparrows were recorded at 264 sites. In 69% of these locations the species was recorded in only a single year; multi-year sightings included 25% of the sites where Baird's were found during 2-3 separate years, 5% were over 4-5 years, and less than 1% where Baird's were found in 6-7 years during the 11-year survey period. Although not all sites were checked regularly, the low percentages of multi-year sightings attests to the vagrancy of the species. Habitat at these 809 locations included 56% pastureland, 29% hayland, 8% cropland and 7% idle.

A major study on Baird's Sparrow and other grassland species was conducted in Manitoba from May 1991 through August 1992 (Davis 1994, Davis and Sealy in press a, Davis and Sealy in press b). This study documented the frequency of parasitism by Brown-headed Cowbirds (*Molothrus ater*) and predation on ground nesting passerines in three grassland fragments in southwestern Manitoba. This study also greatly increased our knowledge of Baird's Sparrows reproductive biology (Davis and Sealy in press a).

MAJOR POPULATIONS: Population centers in the extreme southwest include: 1) the Poverty Plains (grasslands in three townships from Pierson to near Broomhill) that supported 25% of the 1985-1995 sightings; 2) Lyleton-Pierson (the two southwestern-most townships) with 16% of the sightings; 3) Broomhill (two townships with 11% of the sightings); 4) the Pipestonc-Oak Lake area (three townships with 8% of the sightings); and 5) the South Souris River Valley (three townships that contained 7% of the 1985-1995 sites). Together, these five complexes comprise about 2 % of the range of the Baird's Sparrow in Manitoba but supported over two-thirds of the 1985-1995 sightings.

PROVINCIAL STATUS: In the late 1800's, the Baird's Sparrow was referred to as "one of the commonest birds of the prairies westward of Pembina Mountain to Moose River" (Thompson 1891). Lawrence (1925) considered it to be the "dominant" sparrow in alkaline sparsely vegetated flats in southern Manitoba. During the 1930's, healthy populations still occurred in the Winnipeg (Cartwright et al. 1937). Since then, the species has been extirpated in northern portions of its former range in Manitoba and sightings near Winnipeg, in southeast or in southcentral Manitoba are scarce (Cleveland et al. 1980, Copland et al. 1986, Manitoba Avian Research Committee 1986). Lane (1968) who studied the species in southwestern Manitoba considered it to have a "spotty" distribution. Recent distributional studies also indicate a restricted range in extreme southwestern Manitoba, with isolated sightings east to Shoal Lakes and north of Winnipeg and north to Dauphin during extreme influx years (usually when dry conditions prevail throughout much of the Northern Great Plains). The Baird's Sparrow is one of only a handful of species declared endangered in Manitoba since Endangered Species Legislation was drawn up in the early 1990's. The species limited distribution and abundance plus substantial range reductions were reasons for its inclusion.

NATURAL HERITAGE RANK: Not yet determined but suspected to rank at the S2B-S3B level.

HABITAT CONDITION: The once prevalent mixed grass prairies of southwestern and south-central Manitoba have been extensively cultivated and have been replaced by cropland or tame haylands. The few native prairie sites that remain are generally small or have become overgrown with brush or aspen due to suppression of fires. Originally believed to be inflexible in its response to cultivation or grazing (Cartwright et al 1937, Owens and Myers 1973), recent studies have shown that it can be found in tame haylands, pastureland or even croplands (De Smet and Conrad 1991, De Smet 1994). Whether it nests successfully in these habitats, however, remains unknown.

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- Submitted by: Ken De Smet, Natural Resources, Wildlife. Box 520, Melita, Manitoba, Canada R0M 1L0. 204-522-3719

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATE/PROVINCE: SASKATCHEWAN

SUMMARY: Regular breeder. There was no population estimate for the Province that was satisfactory to all of the reviewers.

BBS: Population trends are non-significantly negative for the period 1966 - 1996 (-1.1/year, n=36) (Sauer et al. 1996).

CBC: No records.

ATLAS: The Saskatchewan atlas (Smith 1996) is based on both historic records, casual records and atlas based counts initiated in 1983. Baird's Sparrows were recorded in 146 map sheets (1:50,000) of which almost 38% were in the Moist Mixed Grassland and nearly 37% were in the Mixed Grassland. The remaining regions where the sparrow was encountered were the Aspen Parkland (17%), the Boreal Transition (6%) and the Cypress Upland (2%). The majority of records (about 85 %) were possible breeding with 12% being probable breeding (records from the same site on dates separated by at least a week) and 4% (6 records) confirmed breeding. Probable and confirmed breeding records were confined to the Moist Mixed and Mixed Grass regions except for one probable breeding record in the Cypress Uplands (Smith 1996; Figure A6).

RESEARCH/MONITORING: Considerable research on Baird's Sparrow has occurred in Saskatchewan. BBS surveys have been carried out for 30 years 1966-1995 (Sauer et al. 1996). Research has included the effect of agriculture practices such as grazing or haying (Maher 1979, Dale 1983, 1984, 1990, 1991, 1992, 1993, Dale et al. 1997, Davis et al. 1996), burning (Maher 1973, Driver 1987, Pylypec 1991) general habitat selection (Lein 1968, Dale 1983, 1991, 1992, Anstey et al. 1995), and response to exotic vegetation (Wedgwood 1988, Sutter et al. 1995, Anstey et al. 1995, Davis and Duncan in press, Dale et al. In Prep.), food habits (Maher 1974, 1979), bioenergetics (Sadler and Maher 1974), nestling growth (Maher 1972), productivity (Maher 1973, Dale 1991, 1992, Dale et al. 1997), census techniques (McAdam 1992), population estimate (Skeel et al. 1995) and population status (Davis et al. 1996, Dale In Prep.).

A study examining the effects of habitat fragmentation on nest success of grassland birds, including Baird's Sparrow was initiated in 1995 and is currently ongoing in Saskatchewan, conducted by the Saskatchewan Wetland Conservation Corporation. This study is looking at factors affecting nest success, nest site selection, and minimum nesting size requirements and will be assessing range condition along with the other work. Contact: Stephen K. Davis, 2050 Cornwall Street, Room 202, Regina, SK, Canada S4P 2K5.

A study evaluating the response of grassland songbirds to intensive pulse grazing and spring burning was initiated by the Canadian Wildlife Service at Last Mountain Lake National Wildlife Area in 1997. The study will continue for a minimum of 5 years and is intended to track the response of birds to management being undertaken to control invasion of native grasslands by

exotic plant species. The study will focus initially only on abundance and habitat structure but the intent is to add a productivity component. Contact: Brenda Dale, 200 - 4999 98th Ave., Edmonton, AB, T6B 2X3.

MAJOR POPULATIONS: Last Mountain Lake National Wildlife Area has a population of approximately 2500 pairs (Wayne Harris pers. comm., Brenda Dale pers. obs.) with average densities on idle grasslands of 97 pair /100 ha (Dale 1984). Numbers at this site appear fairly stable over 6 years of surveys (B. Dale, unpub. data).

Glaciated Missouri Plateau (Strata 38) of the Breeding Bird Survey data has the highest number of birds/route in Saskatchewan (CWS, unpub. data).

The highest densities detected by Skeel et al. (1995) were in the Mixed and Moist Mixed Grass regions (Figure A7). Their survey, conducted in 1994, detected 1770 Baird's Sparrows on 3352 samples (of which approximately 90% were grassland). This study calculated a provincial population estimate of 1.9 million individuals (Skeel et al. 1995). One third (34%) of grassland sites visited contained Baird's Sparrow. This study, both its design and conclusions, have been controversial and this population estimate from Saskatchewan was not acceptable to all reviewers. Some of the criticisms of this study and its densities estimates include: 1) The sampling was non-random (selected townships were rejected due to logistical difficulties). 2) It was assumed that all birds were heard within 150 m. an assumption that was unacceptable to many reviewers familiar with point counts in northern prairie grasslands. Small differences in this effective listening distance have a large influence on the resulting density estimates. 3) Samples were not independent, but the analysis used each 0.5 circle as a separate sample (B. Dale, written commun.). However, this is the largest study to date of Baird's Sparrow populations in Saskatchewan and might be the best estimate available until another census is undertaken.

PROVINCIAL STATUS: Endangered species legislation was enacted in Saskatchewan in July 1997 and a scientific committee to determine the listing of species in the province was formed in November 1997. Baird's Sparrow will not be considered for listing unless new information becomes available (S. Davis pers. commun.).

NATURAL HERITAGE RANK: S3B SZN (Jeff Keith, pers. comm.).

HABITAT CONDITION: Coupland (1987), using Census Districts to determine loss of Saskatchewan rangelands, calculated Mixed Prairie rangelands declined from 42% (of all land in mixed grass region) to 31% between 1941 and 1981. Corresponding changes in Fescue Prairie were from 41% to 25%. A different evaluation calculated a combined rangelands ecozone loss of 1.6 million acres, representing 12% of the remaining grassland, between 1974 and 1989 (Gayton 1991). Most of this latter loss occurred 1976 to 1984 coinciding with a steady decline in Saskatchewan BBS annual indices for Baird's Sparrow in that period.

In the period of greatest change in Baird's Sparrow populations (1956-1976), grazing pressure increased from .042 animal units/acre to .056 in the mixed prairie, and from .073 to .095 animal

units/acre in fescue prairie (Coupland 1987). Using combined ecozones to examine the period 1974 to 1989, Gayton (1991) showed grazing intensity peaked in 1981 at .078 animal units/acre and grazing loads were .073 animal unit/ acre in 1989. However, recent range conditions may be better in native pastures than previously thought (S. Davis, pers. commun.). Baird's Sparrow can respond positively to good to excellent range condition (CWS/SWCC unpub. data)

Data on Baird Sparrow use of non-native grasslands is species and landscape specific. Baird's Sparrow occurred as frequently in tame pastures as in native pastures (Davis and Duncan In Press). They showed a non-significant difference in use of grazed crested wheatgrass and grazed native (Sutter et al. 1996) but had a much higher use of idle native than idle crested wheatgrass (Sutter, unpubl. data). Baird's Sparrows had a preference for idle native over idle Brome (Dale et al. In Prep). These differences may be due to the landscape effects between fragmented and extensive grasslands, amount of exotic species present, intensity of grazing, amount of native pasture available in the area or weather conditions.

THREATS: Historically, threats are conversion of grasslands to agriculture, including cropland and haying. Baird's Sparrow's have been observed singing in hayfields, at varying rates throughout the province, however; their reproductive success rates have not been calculated, and these areas may constitute a "sink". Productivity is virtually zero after the hay is cut and there usually isn't time for reproductive success before most early cutting (Dale 1990, Dale et al. 1997).

Other threats include invasion of some species of exotic grasses (Dale et al. In Prep) and intensive grazing rates (Dale 1984, Davis and Duncan In Press, Appendix B).

Predation has been found to be a primary cause of nest failure with frequencies ranging from 26%-46% in Saskatchewan (S. Davis pers. commun.). Baird's Sparrows can be a common Brown-headed Cowbird (*Molothus ater*) host in prairie Canada (Davis and Sealy In Press). In Saskatchewan, 32% of 61 nests were parasitized with 78% of these containing more than one cowbird egg. This study also found parasitism frequency to be negatively correlated with pasture size (S. Davis pers. commun.). On an extensive grassland at Last Mountain Lake, parasitism was <5% (B. Dale, CWS, unpubl. data). The degree of this effect could be large and significantly affect Baird's Sparrow reproduction.

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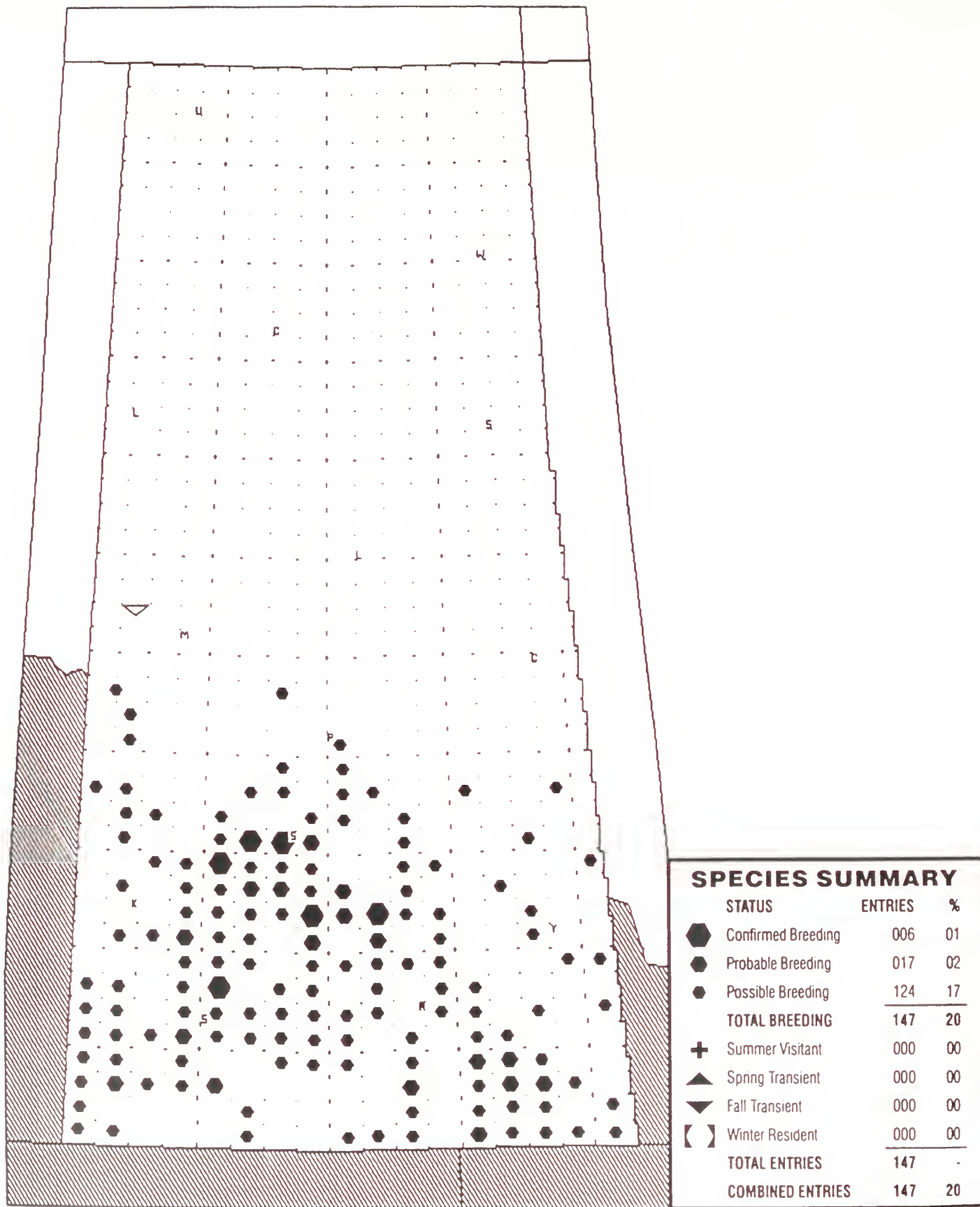
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Submitted by: Brenda Dale, CWS, 4999-98th Ave., Room 200, Edmonton, Alberta, Canada T6B 2X3 403-951-8686, FAX: 403-495-2615, email:brenda.dale@EC.gc.ca February, 1996; final edit by S. L. Jones and M. T. Green, March 1998.



SASKATCHEWAN

Figure A6. Baird's Sparrow (*Ammodramus bairdii*) distribution in Saskatchewan. Locations from Atlas of Saskatchewan Birds (Smith 1996).

NORTHERN SASKATCHEWAN

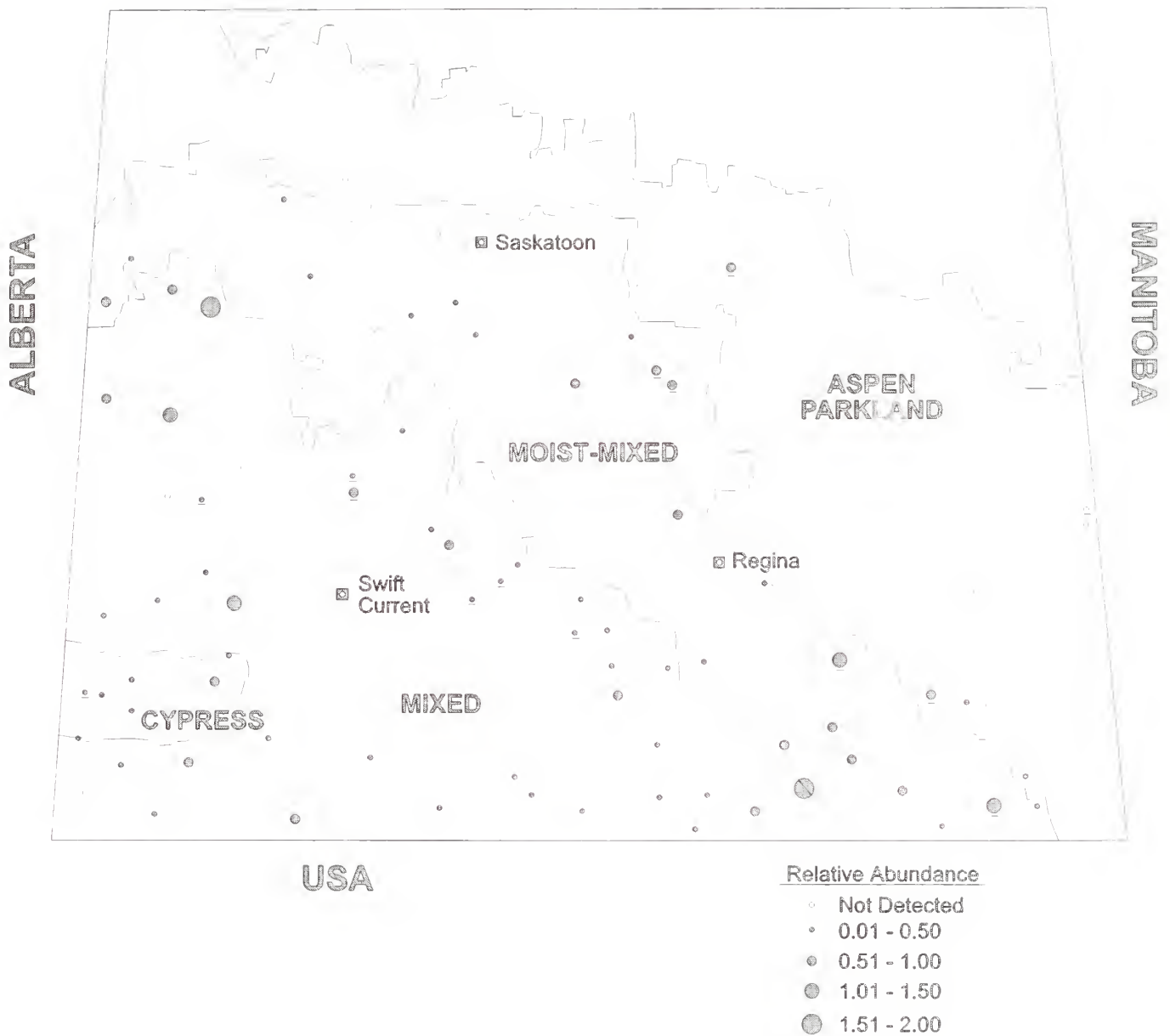


Figure A7. Distribution and relative abundance of Baird's Sparrow in southern Saskatchewan, Canada. Mean numbers of singing males per route recorded inside 100m circles. Routes with <10 points were omitted and non-random routes are underlined (Davis et al. 1996).

STATE AND PROVINCIAL SUMMARIES OF BAIRD'S SPARROW STATUS

STATES: CHIHUAHUA, COAHILA, DURANGO and SONORA (MEXICO)

SUMMARY: Winter resident in grasslands on the Central Plateau. Most of the range has been defined by 26 specimens taken in the late 1800's and early 1900's (listed in Cartwright et al. 1937), encompassing northeastern Sonora, all of Chihuahua, and the western half or two-thirds of Coahuila south to n. Durango (Miller et al. 1957, Howell and Webb 1995). This species probably also occurs in northern Zacatecas. Specimens and sight records are primarily from grasslands in the range of elevations from 1200 m to 2000 m. Timing: August 20 (Sonora) and 27 (Durango) to May 8.

BBS: N/A

CBC: 6 were reported on the Ejido San Pedro, Chihuahua CBC (west of Janos) on 4 January 1997; 10 were reported on the Rancho El Palomino CBC (near Sueco), Chihuahua on 28 December 1996.

ATLAS: N/A

RESEARCH/MONITORING: (1) Colorado Bird Observatory conducted wintering grassland bird surveys at numerous sites on the Central Plateau in the winters of 1995, 1996 and 1997, with the purposes of identifying important wintering locations and habitat associations for Baird's Sparrow and other grassland birds (Leukering and Bradley 1997). (2) Christmas Bird Counts were initiated at Ejido San Pedro, Chihuahua in January 1997, and at Rancho El Palomino, Chihuahua in December 1996.

MAJOR POPULATIONS: Largely unknown.

STATE STATUS: None

NATURAL HERITAGE RANK: N/A

HABITAT CONDITION: A mixed scenario occurs in the Central Plateau. Many of the grasslands are very heavily grazed and probably unsuitable for Baird's Sparrows. However, some grasslands are in better condition than many desert grasslands in the United States.

THREATS: Excessive overgrazing is the major threat to grassland habitats in many parts of the Central Plateau. Development related to the North American Free Trade Agreement may threaten borderland grasslands and other habitats from Sonora to Coahuila.

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Submitted by: Bill Howe, USFWS, Nongame Migratory Bird Coordinator, Region 2, P.O. Box 1306, Albuquerque, New Mexico 87103 505-248-6875; email: Bill_Howe@fws.gov

Appendix B: Summary of Baird's Sparrow Habitat and Management Guidelines

Appendix B: Summary of Habitat and Management Guidelines

Introduction

Presented here are brief summaries and key findings of studies of Baird's Sparrow (*Ammodramous bairdii*) habitat and their management. Consult the original papers, theses or manuscripts for details of both techniques and results. Throughout this review winds a common thread: management techniques and the effects of habitat disturbance on Baird's Sparrows must be considered in light of local conditions. The rate of regrowth and the density of vegetation following specific management activities will especially be influenced by soil and local patterns of precipitation, and thus so will the response of Baird's Sparrows to those activities.

Summary of Habitat Descriptions

One of the major problems with trying to find consistent predictors of any bird species' habitat is that grassland vegetation often varies greatly over time in response to environmental conditions. Measurements from different times of different years are not comparable (Dale 1983, Mahon 1995). Between and within-year variation not only makes identifying exact values difficult but usually precludes pooling data between sites and years. Although many of the studies make use of methodology based on Wiens (1969) or Robel et al. (1970), definitions of categories differ between studies (litter being an example) and between personnel collecting the data. An additional factor that complicates the definition of habitat choices of Baird's Sparrow is the potential nomadism of the species (Kantrud and Faanes 1979, Schmidt 1990, Green 1992, Price 1995). During spring migration birds might first settle wherever suitable habitat exists, leaving other seemingly suitable habitats with fewer individuals in some years but filled to capacity other years; however, in some regions population sizes do not fluctuate as much, and annual site use is more predictable. Moreover, in years when precipitation varies from the normal birds may occupy sites where they are normally absent.

The only published model to date (Sousa and McDonal 1983) was a first attempt at predicting the presence of Baird's Sparrows from measurements of habitat characteristics, but the model fails to consider vegetative characteristics that subsequent studies demonstrate are important to the species. This model shows all vegetation height values above 2.5 dm as equally good, excludes litter from the equation, and does not include other important characteristics, such as measurements of shrub coverage. Table B1 is a summary of Baird's Sparrow densities with various treatments and localities.

Baird's Sparrows are significantly associated with size of grassland fragments. Using 50% occurrence as an indication of a minimum area requirement, Baird's Sparrow is an area sensitive species requiring approximately 63 ha (Davis 1998). This finding complicates the application of these guidelines.

Height and Thickness of Vegetation and Litter

Height of vegetation, thickness of vegetation, or both, either overall or only in the first dm, and litter depth have been identified as important vegetative features for Baird's Sparrows (Dale 1983,

Table B2; Sousa and McDonal 1983; Winter 1994, Table B3; Mahon 1995, Table B4; Anstey et al. 1995; Madden 1996, Table B5; Davis and Duncan in press). The range of vegetation heights of occupied or densely populated sites (1.3 to 3.7 dm) nearly completely overlaps unoccupied or less densely populated sites (1.3 to 4.2 dm) (Tables B2, B3, and B4). However, these numbers may obscure the tendency for Baird's Sparrows to choose sites with lower vegetation heights relative to surrounding vegetation when it is tall (Renken 1983, Table B6 ; Dale 1990, 1991, and 1992; Messmer 1990 Table B7; Madden 1996), and taller vegetation relative to surrounding vegetation when it is short (Dale 1991, 1992, Anstey et al. 1995). These studies bear out the observation that in drier regions or drier years Baird's Sparrows are found in the tallest, thickest vegetation available, and in wetter years or more mesic prairies, Baird's Sparrows occupy grasslands with intermediate or lower vegetation heights and densities (Stewart 1975).

It also appears that Baird's Sparrows tend to choose sites with litter accumulation generally less than 4 cm in height when available, or at least lower than in unoccupied areas if litter depth is high (Dale 1990, 1991, 1992, Madden 1996, Mahon 1995, Winter 1994). However, the measurement of litter depth is inconsistent in different studies and appears as a significant correlate of habitat occupancy in only some of them.

The preference for middle values (within the prairie-wide continuum) of vegetative cover and litter depth seems clear, but defining the lower and upper limits is difficult, as can be seen by viewing Tables B1 - B8. The extreme low and high values are clearly avoided but there is overlap between occupied and unoccupied habitat values. This might be due to decisions the birds make regarding habitat suitability. Habitat selection is likely based on multiple factors; some of these decisions may only come into play near the extremes of habitat acceptability and some decisions may be influenced by how the habitat appears relative to the habitat around it.

Presence of Shrubs

High shrub densities were found to be unattractive to Baird's Sparrows in a number of studies (Dale 1983, Lein 1968, Anstey et al. 1995, Madden 1996). The avoidance of heavy shrub (Cartwright et al. 1937, Lein 1968, Dale 1983, Renken 1983, Arnold and Higgins 1986, Madden 1996) or avoidance of shrubs for cover (Pulliam and Mills 1977) has been reported many times. Renken (1983) felt they had no need for shrub: however, they did choose areas with modest shrub cover in her study. Suggested upper limits have been: 25% (Kantrud IN Sousa and McDonal 1983), 18% (for 50% probability Madden 1996).

Shrubs are not actually needed for protection (Pulliam and Mills 1977). Shrubs may be sought as perches (Prescott and Murphy in review), although Lein (1968) found they preferred to sing from the ground even when shrubs were available; Baird's Sparrow will sing from the ground, grass clumps, forbs or any other perch (Dale 1983). In Manitoba, nests near perches were much more likely to be parasitized by cowbirds than were those far from potential watching posts (Davis 1994). Avoidance of shrubs could also be related to predation by small mammals such as ground squirrels. Nevertheless, Baird's Sparrows do occupy grasslands with low percentage shrub cover, using the highest perches for song, and sometimes nesting at the very base of shrub stems

(S. Davis unpubl. data, M. Green unpubl. data). In North Dakota, this was true where shrubs were young, patchily distributed, and interspersed with grasses (M. Green unpubl data).

Presence of Forbs

The results are mixed with some studies showing forbs are important (Mahon 1995, Madden 1996) and others showing no response, or a negative relationship to forbs or inconsistent results in different years (Renken 1983, Dale 1983, 1991, 1992, Anstey et al. 1995) or that heterogeneity of forbs is important (Winter 1994). This mixture of results may indicate that forbs are not a critical component in habitat choice or it may simply show that the way we have chosen to measure forbs is inappropriate for the mix of their potential uses. For example if forbs are needed for food (directly or through the insect life they harbor) then the abundance of only some forb species may be important, and if the value of forbs is as perches (especially where shrubs are non-existent) then the abundance of emergent forbs may be a critical measure.

Heterogeneity

In Saskatchewan, Dale (1992) found heterogeneity of height was a significant factor in Baird's Sparrow abundance (Dale 1992). Highest densities at in North Dakota were associated with high variability in forb and bunchgrass cover (Winter 1994). Litter was more heterogeneous in the recently burned sites in two years in North Dakota (Madden 1996). Thus, these data suggest that heterogeneity of vegetative characteristics, within territories, might be an important habitat component.

Grazing

Several studies show that Baird's Sparrows are sensitive to the changes in vegetation structure that result from grazing. The extent of the changes, and their responses, will vary with intensity, timing, and duration of grazing, vegetation present, and geographic location (with the different soil and moisture conditions) throughout the prairie.

Studies in the drier portions of the mixed grass (or in drier years) have tended to find that continuous grazing virtually eliminates (Smith and Smith 1966, Owens and Myres 1973, Karasiuk et al. 1977, Dale 1983, 1984), or supports quite low numbers of Baird's Sparrows compared to idle sites grazed prior to, but not during the study years (Maher 1973, 1979) or sites idle for a longer period (De Smet and Conrad 1991, George et al. 1992, Prescott et al. 1993, Davis 1994, Sutter et al. 1995, Dale and Duncan unpubl. data; Table B1). In the moist portions of the mixed grass region some grazing can produce suitable habitat (Kantrud 1981, Renken 1983, Messmer 1990, and see Winter 1994, Madden 1996 for densities in the ungrazed portion of the range). Renken's work should be interpreted carefully as her grazed sites had been idle for a number of years and was not grazed until after her initial counts in both years. She specifically comments that Baird's Sparrows did not "reinvade" sites after the cattle were put in the fields. Increased grazing pressure usually decreases sparrow densities (Kantrud 1981, De Smet and Conrad 1991, Anstey et al. 1995), possibly because intensive grazing decreases residual vegetation and litter (Naeth et al. 1991) both of which are required by Baird's Sparrows in at least moderate amounts.

Kantrud and Kologiski (1982) in North Dakota found that the effect of grazing on Baird's Sparrows depended partly on soil type. Typic Borolls were best while Ustolls and Aridisols had few or no Baird's Sparrows. Although numbers still declined with increased grazing intensity on Typic Borolls, the effect was not so strong as on other soil types, and densities on heavily grazed sites on Typic Borolls were roughly equivalent to lightly grazed sites on the next best soil type.

Some studies have examined the effect of the timing and frequency of grazing disturbance on Baird's Sparrow abundance. Messmer (1990, Table B7) found that twice over rotation produced the highest number of Baird's Sparrows compared to continuous, short-duration and idle sites in a multi-year study. He attributed this to the longer undisturbed period in some paddocks during the nesting period. He also found that Baird's Sparrow densities increased in twice-over-rotation pastures over a 6-year period while declining in other treatments. A two-year study in Alberta found higher numbers of Baird's Sparrows in rotation grazed than in continuously grazed sites with the highest densities in native paddocks not subjected to spring grazing (Prescott et al. 1993, Prescott and Wagner 1996, Table B8). A two-year study in Saskatchewan found no clear differences between continuous and rotation treatments but most rotation treatment pastures had only been under rotation management for two or three years. The only site under long term rotation management had higher numbers of Baird's Sparrows than nearby continuously grazed pasture (Dale and Duncan unpubl. data). This study also found a positive relationship between range condition and Baird's Sparrow abundance. A similar positive relationship was found in an extensive Saskatchewan survey (Anstey et al. 1995). Thus, rotation management can improve range condition from the stand point of grazing economics (Adams et al. 1993), and apparently is complementary with managing habitat for Baird's Sparrows in some areas. In drought conditions in North Dakota, grazed sites in good range condition still attracted Baird's Sparrows while pastures in poor condition did not (George et al. 1992). A five-year study in southeast Saskatchewan found that grass height in rotation pastures increased compared to continuously grazed sites (Trottier and Barry unpubl. data). Mahon (1995) found high densities in winter grazed exotic-dominated sites in southern Alberta (Table B4).

Haying

Early in the century it was thought that mowing native grassland in Manitoba rendered the habitat unsuitable for Baird's Sparrow (Cartwright et al. 1937). In Alberta, haying of native fescue made the site unattractive to Baird's Sparrow in the following year (Owens and Myers 1973) and mowed portions of winter-grazed study plots were avoided (Mahon 1995). Frequencies of occurrence were significantly lower in hayfields than in pastures in a broad survey of southern Saskatchewan (Anstey et al. 1995). In contrast, more Baird's Sparrows were encountered in surveys of hayed grasslands (presumably native) in North Dakota than in most non-native pastures (Kantrud 1981). Native hay land was more attractive than brome/alfalfa hay land in recent surveys in Manitoba (De Smet and Conrad 1991). This result may be because native hay is cut later in the season than sown hay and may be cut irregularly or in patches.

Research in Saskatchewan in 1989-1991 found that Baird's Sparrows was more common in idle native grasslands than in grasslands dominated by exotics that were hayed either annually or

periodically (Dale et al. 1997). Fields cut annually were more suitable than periodically-cut hay fields in some years, possibly because cutting prevented the build up of excessive litter and the tangle of lodged exotic grasses noted in periodically-cut fields. This study, and the lack of Baird's Sparrow in idle planted cover, would indicate that disturbance is needed to make hayfields attractive but the timing of haying is critical to the quality of habitat hayfields provide. Although attractive to Baird's Sparrow, pairs nesting in hayfields experienced greater reproductive failure unless haying was delayed past the July 15th haying date recommended by North American Waterfowl Management Plan guidelines. The July 15th date may not allow most young from first nests to fledge in most years (Dale 1993b). However, the ideal timing of the delay for Baird's Sparrow will vary by site and year, according to local breeding chronology. Delaying haying until the beginning of August, as recommended by Swanson (1996) for Savannah Sparrows (*Passerculus sandwichensis*), will provide a greater margin of safety for passerines nesting in grasslands (Dale et al. 1997). Other options to improve productivity while maintaining site attractiveness is cutting every second year (with the appropriate within season delay) or delayed cutting on only half of any given field each season (Dale et al. 1997).

Burning

The effects of burning, like grazing, appear to vary with soil type and moisture regimes. The variation in the regrowth of vegetation after a fire is likely responsible for much of the variation in natural fire cycles (Bragg 1995 IN Madden 1996) since drier sites or sites with poor soil would take longer to accumulate enough litter or residual vegetation to carry a fire. Virtually all studies find Baird's Sparrow absent in the first breeding season after fire. At Matador, Saskatchewan an idle area burned in a wildfire was surveyed in the next two years and numbers by the second year (11.1/100 ha) exceeded those in grazed areas (9.7/100 ha) but were less than a third of the density found in idle sites (34.3/100 ha) (Maher 1973). At Last Mountain Lake two plots with brush and no Baird's Sparrows were burned once. Baird's Sparrows used the plots in low numbers 2-3 years after the burn (Driver 1987) but their numbers remained below those in non-brushy idle areas (see Dale 1983, 1990) for the duration of the study. Further north in Saskatchewan it took three years post fire for Baird's Sparrow numbers to equal those in idle sites (Pylypec 1991). Two studies at Lostwood, northwest North Dakota found that sites reached maximum densities of Baird's Sparrow in 1-3 years post fire and that sites burned four times in 15 years had the highest densities (Winter 1994, Madden 1996). In general, sites 5-8 years post burn have lower densities and areas idle for longer periods lack Baird's Sparrow.

There may be several reasons for the different responses exhibited in these studies. The Saskatchewan sites have lower annual precipitation so that build up of residual vegetation and litter takes longer. In addition, the encroachment of western snowberry (*Symphoricarpos occidentalis*) and other shrubs into idle sites is slower. At Lostwood idle sites averaged greater than 40 percent shrub cover, and measurements of a combination of height and density (using Robel et al. 1970) were higher than similar measurements at idle sites in Saskatchewan (Table B2). In fact, burned sites in North Dakota were structurally taller and thicker than idle sites on poorer, drier soils in Saskatchewan. The interval between natural fires is estimated to have been up to 25 years, on average, in the drier portions of the mixed-grass prairie (such as at Last

Mountain Lake, SK) (Bragg 1995 IN Madden 1996), whereas in moister portions of the northern Great Plains (such as at Lostwood, ND) the interval between natural fires is estimated to be closer to six years. Controlled burning at Lostwood using 5- to 7- year burn intervals produces sites of maximum attractiveness to Baird's Sparrows. Controlled burning should be considered as a management technique at other sites using natural fire intervals.

Conversion to Non-native Vegetation

Baird's Sparrow densities in non-native vegetation varied by plant species and density, locale, and management techniques (Table B1). This is consistent with the concept that these birds are selecting habitats based in part on the structure of the vegetation. Vegetation structure is produced by a combination of the species composition and climate of the region; however, this structure may be manipulated by techniques used to manage those plants.

A negative relationship has been found between the presence of smooth brome (*Bromus inermis*) left idle and the number of Baird's Sparrows (Dale et al. in review). However, cutting (Dale et al. 1997), grazing (Mahon 1995), or burning (Madden 1996) appear to improve the attractiveness of brome to Baird's Sparrows, possibly because these methods prevent the thick build-up of recumbent stems. Smooth brome and quack grass (*Agropyron repens*) can build up litter and standing residual vegetation faster than native plants. The broad leaves and high biomass of these grasses increases the dead matter at ground level leading to conditions unsuitable to Baird's Sparrow, possibly because litter impedes movement along the ground (Dale et al. in review) or increases predation (S. Davis pers. commun.). Dense, monotypic stands of smooth brome and quack grasses might also negatively affect prey diversity and biomass.

Dale et al. (in review) and Madden (1996) found that encroachment by Kentucky bluegrass (*Poa pratensis*) into native grasslands does not have a detectable effect on Baird's Sparrow. It is narrow leaved and has a short stature compared to smooth brome, making it similar to many native bunch grasses in shape and size. However, most Saskatchewan sites sown to bluegrass and other exotics were not suitable for Baird's Sparrow 2-3 years after establishment (Dale 1992, 1993a).

The results for crested wheatgrass (*Agropyron cristatum*) are mixed. Crested wheatgrass may be suitable for Baird's Sparrow since it is structurally similar to native grasses, particularly when grazed (Madden 1996, Davis and Duncan in press) and has shown to have equal or higher numbers of Baird's Sparrows in comparison between grazed stands of native grasses and grazed stands of crested wheatgrass in Saskatchewan (Davis and Duncan in press, Skeel et al. 1995, Sutter et al. 1995) and Alberta (Mahon 1995, Prescott and Bilyk 1996). Idle crested wheatgrass in North Dakota was not attractive to Baird's Sparrow (densities by county from Johnson and Schwartz 1993a, seed mixes from Johnson and Schwartz 1993b). Seeding mixes, seed row spacing (percent bare ground), grazing rates and landscape effects may account for much of the variability in response. There are no comparisons of productivity in grazed native and crested wheatgrass pastures.

Leafy spurge (*Euphorbia esula*) and western snowberry are exotic species that are invading native prairie and other untilled uplands. In some geographic areas, idle native prairie can gradually become dominated by these species and both of these species create stands and conditions that make the habitat unsuitable for Baird's Sparrows.

Mixes of exotic plants seeded as part of the Conservation Reserve Program or as Dense Nesting Cover for waterfowl attracts few (North Dakota, Johnson and Schwartz 1993a) or no Baird's Sparrows (Canada, Renken 1983, Dale 1991, 1993a, Prescott and Murphy in review, Dhol et al. 1994).

The conversion of native prairie to crops has a dramatic effect on Baird's Sparrow as they have been reported to make either no use or only limited use of cropland (Wedgwood 1988, Johnson and Schwartz 1993a, Skeel et al. 1995). Casual observations indicate that minimum till fields with standing stubble and weeds are chosen over tilled fields. A southern Alberta study found Baird's Sparrow sang on 1.3 % of cropland study plots in 1995 and none in 1996 (Martin 1977) but was in minimum till spring wheat and the were never heard singing in conventionally tilled fields and no evidence of productivity was observed in either type habitat.

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Submitted by: Brenda Dale, Canadian Wildlife Service, 4999-98th Ave, Room 200, Edmonton, Alberta CANADA T6B 2X3. 403-951-8686, FAX: 403-495-2615, email: Brenda_Dale@EC.gc.ca

Table B1. Summary of densities or frequencies of occurrence under various treatments in a variety of locales

Reference	Treatment/Cover Type	Density or Frequency	Location
Grazing			
Smith and Smith 1966	Grazed native	0	Regina, Saskatchewan
	Grazed fescue	0	
Owens and Myres 1973	Idle fescue	0.19-0.56/ha	Alberta
Karasiuk et al. 1977	Grazed native	0	Suffield, Alberta
	Grazed native	0-0.05/ha	
Dale 1983	Idle native	0.92/ ha	Last Mtn. Lake, Sask.
	Grazed native	0.05/ha	
Maher 1979	Idle native	0.29/ha	Matador, Saskatchewan
	Grazed native	0.012/ha	
DeSmet and Conrad 1991	Idle	0.032/ha	southwest Manitoba
George et al. 1992	Grazed native	0 - 0.075/ ha	North Dakota
	Rotation Grazed native	39.6%	
Prescott et al. 1993	Continuous grazed native	16.7 %	Medicine Wheel, AB-'93
	Grazed native	0.25 nest/ha	
Davis 1994	Idle native	0.5 nest/ha	southwest Manitoba
	Grazed native	apr. 0.24/ ha	
Sutter et al. 1995	Idle native	apr. 0.52/ ha	Matador, Saskatchewan
Dale and Duncan unpubl. data.	Grazed native	0.247 /ha	southern Saskatchewan
	Heavy grazing	0.029/min.	
	Light grazing	0.049/min.	
Kantrud 1981	Moderate grazing	0.057/min.	North Dakota
	Grazed (just initiated)	0.095/ha	
Renken 1983	Idle	0	North Dakota
	Continuous graze	0.03-0.05/ ha	
	Short duration graze	0.08-0.12/ha	
	Twice over rotation	0.06-0.15/ha	
Messmer 1990	Idle	0.04/ha	North Dakota
Madden 1996	Idle	0-0.04/ha	North Dakota
	Rotation grazed native	77.1 %	
Prescott and Wagner 1996	Continuous grazed native	33.3 %	Medicine Wheel, AB - '95
	Grazed fescue	27.8 %	
Prescott and Bilyk 1996	Grazed mixed grass	14.8 %	southern Alberta

Table 1, continued

Reference	Treatment/Cover Type	Density or Frequency	Location
Lein 1968	Idle native	0.22/ha	Saskatoon, Sask.
Dale et al. in press	Idle (1989-1991)	0.84 /ha	Last Mtn. Lake, Sask.
Pylypec 1991	Idle native	0.27-0.54 / ha	Saskatoon, Sask.
Skeel et al. 1995	Grazed native	0.135 /ha	southern Saskatchewan
CWS, unpub. Data	varied grazing intensities	0.02 /ha	Suffield, Alberta
Cover Type			
	CRP ¹	0.016 / ha	
Johnson and Schwartz 1993a	Cropland	0	North Dakota
	DNC ²	0	Saskatchewan
Dale 1993a	Cropland	0	southern Saskatchewan
Dale 1992, 1993a	blue grass/red fescue	0 - 0.045/ ha	Saskatchewan
Dhol et al. 1994	DNC	0	Manitoba
Prescott & Murphy in review	DNC	0	Alberta
Renken 1983	DNC	0.05 /ha	North Dakota
	Native idle	100 %	
Dale et al. in review	Exotic invaded idle	28-75%	Last Mtn. Lake, Sask.
Prescott et al. 1993	Tame Pasture	20.8 %	Medicine Wheel, AB
Prescott and Wagner 1996	Tame Pasture	41.7 %	Medicine Wheel, AB
Mahon 1995	Winter grazed exotic	0.17-0.59/ha	southern Alberta
	Tame pasture	0.129 /ha	southern Saskatchewan
	Hayland (exotic)	0.09 /ha	southern Saskatchewan
Skeel et al. 1995	Cropland	0.01-0.02/ha	BBS data 1994
Sutter et al. 1995	Grazed Crested Wheatgr.	apr. .36 /ha	Matador, Saskatchewan
	Tame pasture	18.8%	
	Cropland	0 %	
Prescott and Bilyk 1996	Hayland (exotic)	8.3 %	southern Alberta
	Native hay	0.05 /ha	
	Brome/alfalfa hay	0.015 /ha	
DeSmet and Conrad 1991	Cropland	0.0006/ha	southwest Manitoba
Dale and Duncan unpubl. data	Tame pasture	0.117 /ha	southern Saskatchewan
CWS unpub. data	Cropland	0 - 1.3 %	Srn. Alberta (1995-96)
Kantrud 1981	Native hay	0.059 /min	North Dakota
Davis 1994	Native hay	0.23 nest/ha	southwest Manitoba

1 - CRP = Conservation Reserve Program

2 - DNC = Dense Nesting Cover

Table B2: Structural Measurements of Vegetation in Baird's Sparrow Habitat, Last Mountain Lake, SK

	1980 ^a		1981 ^a		1990 ^b		1991 ^b		Sask. 1994 ^c		Alberta 1995 ^d	
	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent
Sample size ^e	92	324	100	460	52	15	28	20	103	95	26	79
Litter (mm)	11.3	8.7	7.3	6.5	7.77	8.90	5.22	9.15	6.62	5.04	3.62	4.11
Horizontal Density	43.0	25.1										
Total Hits			10.6	7.6	16.44	17.04	13.07	14.19	7.64	6.37	12.10	8.81
Height (in)	8.4	5.4										
Last dm			2.0	1.5	2.53	2.67	2.85	3.57	1.59	1.42	1.96	2.16
Hits/1 st dm			8.5	6.6	13.17	13.45	9.63	9.36	6.16	5.37	6.66	5.55
% Grass	76.1	80.0	65.0	59.6								
Broad					.29	.52	1.13	2.24	.04	.02	.03	.02
Narrow					1.15	1.50	1.53	1.09	2.84	2.45	2.79	2.59
% Dead	14.1 ^f	8.0	98.0	91.1								
Dead					14.31	14.78	9.14	10.03	3.24	2.51	5.32	4.46
% Forb	12.0	10.8	12.0	11.5							.33	.33
Forb distance (cm)	17.9	16.0	14.2	28.1								
% Shrub	7.6	7.0	1.0	4.1								
Shrub distance (m)									37.59	29.6	16.71	3.27
Litter CV					52.90	51.07	68.64	61.75				
Total CV					61.40	53.80	58.43	52.60			46.64	52.47
Last DM CV					44.31	42.07	42.82	38.15			43.89	47.26
Hits/1 st CV					66.69	61.40	70.82	61.25			45.98	56.59
Broad CV					121.98	129.40	74.93	91.85				
Narrow CV					140.98	129.20	53.04	152.85				
Dead CV					68.15	62.00	75.79	61.25				

a - Grazed vs ungrazed native (ry years and location). Dale 1983

b - Ungrazed native, periodically and annually hayed non-native vegetation. Dale 1991, Dale 1992

c - Continuous and rotationally grazed. Canadian Wildlife Service and Saskatchewan Wetland Conservation Corporation unpublished data.

d - Inventory of area with variety of grazing and burning disturbances. Canadian Wildlife Service unpublished data

e - Methodology after Wiens (1969). See Dale 1983, 1991, Dale (in prep) for details

f - In 1980 (only) dead grass was incorrectly classified as grass instead of dead.

Table B3. Baird's Sparrow numbers and structural characteristics of areas subjected to different burning regimes (Winter 1994)

	Four burns	Two burns	Zero burns
Baird's Sparrow Density	3.2/16ha	1.1/ 16 ha	0
Robel	.63	1.1	1.06
Litter Depth (mm)	2.5	22.5	29.0
Mean Height (dm)	1.27	1.68	1.85

Table B4. Summary of structural measurements for Baird's Sparrow (Mahon 1995 and Madden 1996)

	Alberta-Site A (Mahon 1995)		Alberta-Site B (Mahon 1995)		North Dakota (Madden 1996)	
	Present	Absent	Present	Absent	Present	Absent
Sample size	270	272	300	300	53	97
Litter depth (mm) ^a	57.6	60.2	58.9	65.2	37	43
Robel					1.6	2.3
Last dm	1.92	1.96	1.79	1.92	3.7 ^b	4.2
Hits/1 st dm	2.73	2.36	3.46	2.67		
Total Hits	6.68	6.13	8.16	7.53	18.6	22.5
% Shrub	.00003	.00005	.0005	.01	20.1	33.4
% Forb	1.46	.84	1.03	.50	25.2	21.7
% Grass	78.66	89.62	83.38	87.23	44.4	29.5

a – Litter depth in these studies is not equivalent to those in Table 2.

b – Last dm reading obtained by personal communication.

Table B5. 1993 Baird's Sparrow numbers and structural characteristics of areas subjected to different burning regimes (Madden 1996)

	1-3 years since burn (1993/1994)	5-7 years since burn (1993/1994)	>80 years since burn (1993/1994)
Baird's Sparrow Density	0.12/0.37	0.05/0.08	0/0
Robel	1.56/1.59	2.04/2.10	3.17/3.21
Litter Depth (mm) ^a	20.9/37.2	51.6/54.5	54.3/55.9
Total	17.94/18.40	23.87/24.9	28.69/27.94
% Shrub	19.22/18.84	24.78/31.18	41.53/49.27
% Forb	23.88/25.59	26.57/25.23	15.20/14.94
% Grass	32.67/41.67	19.99/29.70	22.65/23.37
Robel CV	47.0/37.81	41.95/41.59	54.40/45.08
Litter CV	98.01/81.45	59.76/57.03	51.70/55.05
Total CV	36.81/37.34	38.5/33.72	32.91/32.63

A - Litter depths in this study are not equivalent to those in Table 2.

Table B6. Two types of habitat analyses for Baird's Sparrow on North Dakota Waterfowl Production Areas (Renken 1983)

	Comparison of means for used and unused plots		Comparison of used and unused areas within plots ^a	
	used	unused	used	unused
% cover grass	65.9	63.5	57.7	62.5
% cover forb	29.2	25.4	23.8	24.2
% cover litter	99.0	99.2	99.7	98.3
% cover shrub	0.4	11.4	0.9	0.4
% bare ground	0.4	0.3	0.3	0.7
Effective height (dm)	1.5	2.6	1.3	1.3
Litter depth (cm) ^b	3.0	2.6	3.6	3.2
MVC/10 cm intervals ^c	6.4	7.2	6.1	5.9

a - In this analysis the "unused" sample includes only unused segments of plots where Baird's Sparrows were found and excludes all Idle Native plots.

b - Litter definition and measures are not equivalent to those in Table 2.

c - The description of the meaning of this variable is confusing but can be interpreted as the average number of contacts in each of the 7 DM measured.

Table B7: Baird's Sparrow frequency and vegetative characteristics of components of continuous and rotation grazing systems in two years
(Prescott et al. 1993, Prescott and Wagner 1996)

	Continuous		Tame (Early grazing)		Early Season Native		Deferred Native	
	1993	1995	1993	1995	1993	1995	1993	1995
Baird's Sparrow frequency	16.7	33.3	20.8	41.7	70.0	87.5	79.2	66.7
Litter depth (mm)	1.41	8.93	0.41	1.56	1.84	12.03	2.78	11.14
Effective Height (dm)	1.34	1.57	0.96	1.42	2.28	1.83	1.74	1.20
Total Hits	2.68	4.96	1.83	2.72	5.56	5.41	5.32	6.15
Hits/First dm	2.05	4.68	1.41	2.39	3.68	4.65	3.98	5.70
Dead	1.47	3.07	0.47	1.31	2.20	2.89	2.51	3.58
Narrow Grass	1.17	1.80	0.96	0	3.25	2.27	2.77	2.50
Broad Grass	1.01	0.02	0.32	1.31	0.01	0.15	0	0
Forb	0.02	0.08	0.07	0.09	0.10	0.08	0.05	0.08
Shrub	0	0	0.01	0	0	0.02	0	0

Table B8: 1988 and 1989 Baird's Sparrow numbers and structural characteristics of areas subjected to different grazing regimes
(Messmer 1990)

	Short Duration		Continuous		Twice over Rotation		Idle	
	1988	1989	1988	1989	1988	1989	1988	1989
Baird's Sparrow	3.0/ 100 ha	6.3/ 100 ha	2.1/100 ha	2.8/ 100 ha	15.6/100 ha	6.3/100 ha	0	8.9
Density	44.4	96.7	70.2	89.6	60.2	85.9	122.9	101.9
Effective Height	2.4	4.8	3.0	4.3	3.1	3.9	4.1	5.3
Mean Height (dm)	1.7	3.3	1.7	3.3	1.8	2.8	3.1	3.5
% Shrub	14.7	17.8	14.3	17.6	14.0	19.6	10.7	16.0
% Forb	4.3	8.4	3.8	5.0	5.6	6.4	8.5	7.0
% Grass	45.0	54.0	40.8	52.0	37.3	50.8	26.0	56.5
Litter (mm) ^a	80	80	80	80	80	110	180	30

a - Litter definition and measures are not equivalent to those in Table 1

Appendix C:
List of Baird's Sparrow Conservation Plan
Reviewers, Individuals and Agencies
Contacted

APPENDIX C. LIST OF BAIRD'S SPARROW CONSERVATION PLAN REVIEWERS, INDIVIDUALS AND AGENCIES CONTACTED

Carla Alford
BLM
198 Neel Avenue
Socorro, NM 87801
(505) 835-0412

Janissa Balcomb
HC 87, Box 5204
Lewistown, MT 59457
406-538-7851

Joe Ball
MT Coop Wildlife Research Unit
Univ. of Montana
Missoula, MT 59812
406-243-5372
email: ball1@selway.umt.edu

Chuck Carlson
P.O. Box 227
Fort Peck, MT 59223
406-526-3245

Jasper Carlton
Biodiversity Legal Foundation
P.O. Box 18327
Boulder, CO 80308-88327

Mike Carter
CBO
13401 Piccadilly Road
Brighton, CO 80601
303-659-4348
email: cobirdobs@aol.com

Dan Casey
MT Dept. of Fish, Wildlife and Parks
490 N. Meridian
Kalispell, MT 59901
406-752-5501
email: dancasey@digisys.net

Andrea Cervoski
WY Game & Fish
260 Buena Vista
Lander, WY 82520
307-332-7723 x232
email: acervov@missc.state.wy.us

Brenda Dale
Canadian Wildlife Service
4999-98th Ave, Room 200
Edmonton, Alberta
CANADA T6B 2X3
403-951-8686
FAX: 403-495-2615
email: Brenda_Dale@EC.gc.ca

H. Loney Dickson
Canadian Wildlife Service
4999-98th Ave., Room 200
Edmonton, Alberta
CANADA T6B 2X3

Jim Dinsmore
Iowa State University
Department of Animal Ecology
Ames, IA 50011
515-294-7669
email: oldcoot@iastate.edu

Ken De Smet
Natural Resources, Wildlife
Box 520
Melita, Manitoba
CANADA ROM 1L0
204-522-3719
FAX: 204-522-3525

Stephen Davis
SK Wetland Cons. Corp.
2050 Cornwall Street, Room 202
Regina, SK
CANADA S4P 2K5
306-787-0711
email: sdavis@wetland.sk.ca

Dennis Flath
MT Dept. of Wildlife, Fish and Parks
1400 South 19th St.
Bozeman, MT 59715
406-994-6354

Gary Foli
USFS
HC2, Box 8
Watford, ND 58854

Geoff Geupel
PRBO
4990 Shoreline Hwy
Stinson Beach, CA 94924
415-868-1221 x 30
email: ggeupel@prbo.org

Caleb Gordon
University of Arizona
Bioscience W, Rm. 210
Tucson, AZ 84621
520-621-3458
email: calebg@u.arizona.edu

J. Paul Goossen
Canadian Wildlife Service
4999-98th Avenue, Room 200
Edmonton, Alberta
CANADA T6B 2X3
403-951-8679
email: Paul_Goossen@EC.gc.ca

Todd Grant & Beth Madden
J. Clark Salyer NWR
P.O. Box 66
Upham, ND 58789
701-768-2548
email: Todd_Grant@fws.gov
Elizabeth_Madden@fws.gov

Mike Green
USDA-APHIS
4700 River Road, Unit 150
Riverdale, MD 20737-1237
301-734-7121
FAX: 301-734-5992
email: Michael.T.Green@usda.gov

Chris Grondalh
ND Game and Fish
100 N. Bismarck Expr.
Bismarck, ND 58501
701-328-6612

Tedd Gutzke
Medicine Lake NWR Complex
223 North Shore Road
Medicine Lake, MT 59247-9600
406-789-2305
FAX: 406-789-2350
email: R6RW_MLC@fws.gov

Bill Haglan
Charles M. Russell NWR
P.O. Box 110
Lewistown, MT 59457
406-538-7521
FAX: 406-538-7521

Lou Hanebury
USFWS-ES
2900 4th Ave. N., Room 301
Billings, MT 59107
(406) 347-7366
FAX: (406) 247-7364

Paul Hendricks
P.O. Box 2105
Missoula, MT 59806
406-258-2954

Ann Henry
P.O. Box 40627
Albuquerque, NM 87196

Jim Herkert
IL Endangered Species
524 So. Second St.
Springfield, IL 67701
217-785-8687

Bill Howe
USFWS-Region 2
P.O. Box 1306
Albuquerque, NM 87103
505-248-6875
FAX: 505-248-7885
email: Bill_Howe@fws.gov

Doug H. Johnson &
Lawrence Igl
NPWRC
8711 37th St., SE
Jamestown, ND 58401
701-252-5363
email: Larry_Igl@usgs.gov
Douglas_H_Johnson@usgs.gov

Stephanie L. Jones
USFWS-Region 6
P.O. Box 25486, DFC
Denver, CO 80225
303-236-8145 ext. 608
FAX: 303-236-8680
email: Stephanie_Jones@fws.gov

Rolf Koford
IA Coop Unit, Animal Ecology
Iowa State
Ames, IA 50011
515-294-3057

Dave Krueper
BLM
1763 Paseo San Luis
Sierra Vista, AZ 85623
520-458-3559
email: dkrueper@az.blm.gov

Fritz L. Knopf, Susan Skagen & Janet Ruth
USGS-BRD-MESC
4512 McMurray Avenue
Ft. Collins, CO 80525-3400
970-226-9461
email: fritz_knopf@usgs.gov
susan_skagen@usgs.gov
janet_ruth@usgs.gov

Steve Lewis
USFWS, Region 3
1 Federal Drive
Ft. Snelling, MN 55111
612-713-5973
email: Steve_J_Lewis@fws.gov

Steve Martin
Benton Lake NWR
P.O. Box 450
Black Eagle, MT 59414
406-727-7400
FAX: 406-727-7432
email: R6RW_BNL@fws.gov

Clint McCarthy
USFS-Custer NF
P.O. Box 2556
Billings, MT 59103
406-657-6361

Terry McEneaney
Yellowstone NP
P.O. Box 168
Yellowstone, WY 82190
307-344-2148

Bruce McGillivray
Alb. Prov. Mus.
12845 - 102 Ave.
Edmonton, Alb.
CANADA T5N 0M6

Nell McPhillips & Doug Searls
USFWS-ES
420 S. Garfield Ave., #400
Pierre, SD 57501-5408
605-224-8693

Robert Murphy
Des Lacs NWR Complex
P.O. Box 578
Kenmare, ND 58746
701-385-4046
FAX: 701-385-3214
email: Robert_Murphy@fws.gov

Lori Nordstrom
USFWS-ES
100 N. Park, #300
Helena, MT 59601
406-449-5225

Christine Paige
Ravenworks Ecology
612 Lolo Street
Missoula, MT 59802
(406) 728-5220
email: cpaige@montana.com

Charlie Pelizza
Lake Andes NWR
R.R. #1, Box 77
Lake Andes, SD 57356
605-487-7603
Charlie_Pelizza@fws.gov

Dan Petit & John Trapp
USFWS, MBMO
4401 N. Fairfax Drive, Rm. 634
Arlington, VA 22203
703-358-1821
email: Dan_Petit@fws.gov
John_Trapp@fws.gov

Fritz Prellwitz and Paula Gouse
Bowdoin NWR
HC 65, Box 5700
Malta, MT 58538
406-654-2863
FAX: 406-654-2866
email: R6RW_BWD@fws.gov

Dave Prescott
Alberta NAWMP Center
10011 109 Street
Edmonton, Alberta
CANADA T5J 3S8
(403) 422-1040
FAX: (403) 422-1045

Dan Reinking
Sutton Avian Research Center
P.O. Box 2007
Bartlesville, OK 74005
918-336-7778

Terry Rich
BLM
1387 S. Vinnell Way
Boise, ID 83706
208-373-4043
email: trich@ia.blm.gov

Jay Rotella
Montana State University
Dept. of Biology
Bozeman, MT 59171-0346
406-994-5676
email: ubjir@msu.oscs.montana.edu

Dick Roth
USFS
1920 Valley Drive
Pueblo, CO 81008
(719) 545-8737
FAX: (719) 543-8926

Al Sapa
USFWS-ES
2900 4th Avenue
Billings, MT 59107
701-250-4481
email: r6fwe_bis@fws.gov

John R. Sauer
USGS-BRD-PESC
11410 American Holly Drive
Laurel, MD 20708
email: John_R_Sauer@usgs.gov

Eileen Stukel & Doug Buckland
SD Game and Fish
523 East Capital
Pierre, SD 57501
605 773-4229

Dan Sullivan
Montana Dept. of Agriculture
Box 20021
Helena, MT 59620-0201
406-443-4229

Jack Whetstone
BLM
1763 Paseo San Luis
Sierra Vista, AZ 85623

Michelle Williams
BLM
80 Airport Road
Lewistown, MT 59457
406-538-7451

Maiken Winter
Dept. Biological Service
University of Missouri
105 Tucker Hall
Columbia, MO 65211
573-882-4854

Tara Zimmerman
U.S. Fish and Wildlife Service
911 N.E. 11th Avenue
Portland, OR 97232
503-231-6164
email: Tara_Zimmerman@fws.gov

Clemson University

3 1604 012 529 576

[illegible]

Nongame Migratory Bird Coordinator
PO Box 25486, Denver Federal Center
Denver, CO 80225-0486
303/236 7890

U.S. Fish & Wildlife Service
<http://www.fws.gov>

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